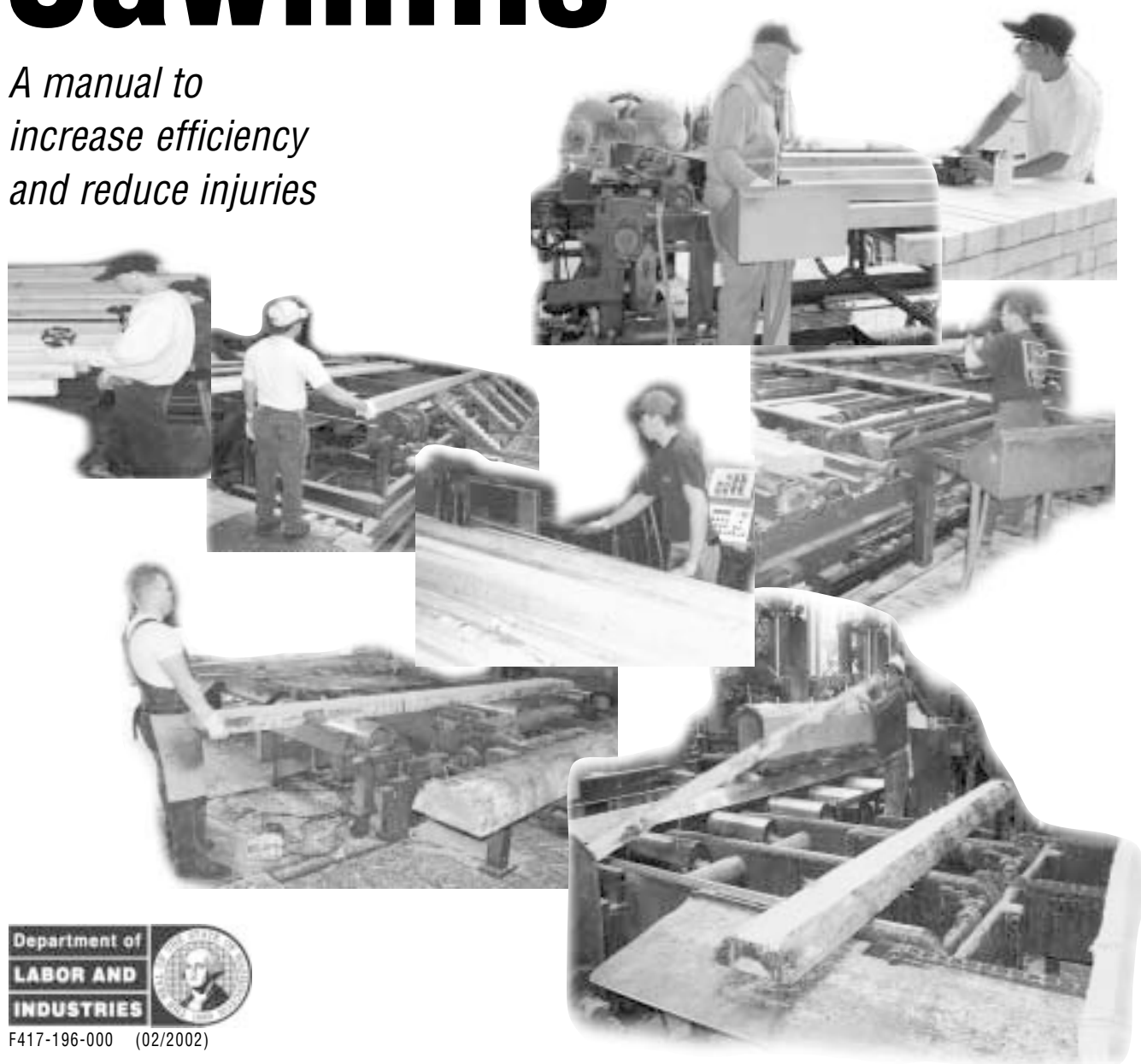


# Lumber Handling in Sawmills

*A manual to  
increase efficiency  
and reduce injuries*



# Table of Contents

<b>Introduction .....</b>	<b>1</b>
<b>Lumber Handlers—Risks and Controls .....</b>	<b>5</b>
Controlling Hazards .....	6
Machine Off Bearer .....	7
Edger Operator .....	10
Resaw Operator .....	12
Straightener/Drop Sorter .....	14
Trim Saw Operator .....	16
Planer Operator .....	18
Grader .....	20
Puller .....	21
Bander Operator .....	23
<b>Resource Pages.....</b>	<b>25</b>
Ergonomic Awareness Education .....	26
Job-specific Training .....	27
Frequency of Injuries .....	28
A Quick Guide to Managing Claims .....	29
Core Ergonomic Principles .....	31
Glossary .....	32
Other Resources .....	35
Job Rotation .....	36
L & I Regional Service Centers .....	41
Ergonomics Rule (WAC 296-62-051) and Appendices .....	43
<b>Checklists .....</b>	<b>61</b>
Caution Zone Checklist (WAC 296-62-05105)	
Hazard Zone Checklist (WAC 296-62-05105)	



# Introduction

**T**his manual is a working tool developed through the cooperation of labor, business and the Department of Labor and Industries. It was created to help mill operators, supervisors, and workers find risk factors within sawmill jobs that are known to cause *work related musculoskeletal disorders (WMSDs)*. It will also help mills to reduce worker exposure once these risk factors have been found.

This guide is only for **lumber handling** jobs in sawmills. For the purposes of this guide lumber handlers are:

- Machine off bearers
- Edger operators
- Resaw operators
- Straighteners/drop sorters
- Trim saw operators
- Planer operators
- Graders
- Pullers
- Banders

Some sawmills may use different names for these jobs. A description of each job is at the top of that section.

Using this manual can help you find out what WMSD risks there are for specific jobs in your mill.

A WMSD is an injury to the soft tissues of the upper extremity, lower extremity or low back that happens over time due to highly repetitive motions, high force, or awkward postures or combinations of these risk factors. Typical WMSDs are tendinitis, carpal tunnel syndrome, and low back strain.

In the state of Washington there are over 50,000 claims from (WMSDs) each year, with direct costs of \$410,000,000.

The Washington State Ergonomics Rule was adopted on May 26, 2000. It defines a method of addressing the risk factors that can cause these injuries before they happen. It uses a progressive method of identifying tasks within jobs that have potential to create these injuries, and provides a system of reducing them below hazard level. By understanding the rule, and using the checksheets associated with it, employers can determine if WMSD hazards exist in their business and take measures to reduce or eliminate them.

If you employ more than 50 employees (full time equivalents), your analysis of the jobs described in this manual and all other jobs at your site (millwrights, office, etc.) must be complete by July 1, 2002. If you have less than 50 employees (full time equivalents), your analysis must be complete by July 1, 2003. In both cases, you must reduce any found hazards as described in section 296-62-05130 of the rule on page 47.

This manual offers a list of possible control measures to reduce worker exposure. It is important for you to know that these may not be the only controls available.

## Lumber Handling in Sawmills

**A manual to increase efficiency and reduce injuries in sawmills.**

## What are WMSDs?

**There are over 50,000 claims each year**

**The Washington State Ergonomics Rule  
WAC 296-62-051**

## Controls

## Who participated in the project?

Whatever control(s) you choose, they will be one or more of these three types of recognized controls.

**Engineering controls** - changes to the workstation, tools or equipment to reduce or eliminate the hazards.

**Administrative controls** - such as job rotation or reorganization of the production process to reduce exposure time to risk factors, or a redesign of the job.

**Work practice controls** - changes in work methods, employee retraining, and monitoring to be sure the changes are actually followed and effective.

The research and development team for this manual consisted of:

- Six industry representatives
- L&I staff from:
  - Region 4 (Southwest WA)
  - WISHA (Washington Industrial Safety and Health Act) Services
  - SHARP (Safety and Health Assessment & Research for Prevention)

Five volunteer sawmills were visited and their lumber handling processes were evaluated on-site for the presence of WMSD risk factors.

- Weyerhaeuser-Aberdeen Lumber
- Mary's River Lumber Co.
- Caffall Brothers Forest Products
- Columbia Vista Corporation
- Glenn Custom Milling LLC

The participating sawmills volunteered as demonstration sites, allowing detailed analysis of work processes and practices. Information collected was used to create this manual and will be shared with the industry.

The Department of Labor and Industries would like to also thank USNR, Woodland, Washington, for their help on the use of engineering controls and clarifying circumstances in which certain controls are indicated within sawmills.

The manual also includes education materials for sawmills to use in meeting the requirements of Washington's ergonomics rule. One mill operator called it,

***"A new way of doing business, a trend for the future,  
and a real attempt to fit the job to the human – not  
throwing the human at the job, hoping he sticks."***

The success in planning and implementing this initiative is a direct result of the cooperative relationship fostered with business, labor and L&I. This relationship, along with a commitment to collaborate in controlling the risk factors which cause WMSD's in the sawmill industry, led to this guide. We especially thank the following individuals for their time and effort devoted to this project. Without their help this manual would not exist.

**Bruce Scharen**, Workers Compensation and Safety Manager,  
TOC Management Services, (retired)

**Jim Neeley**, 3<sup>rd</sup> District Vice President,  
Washington State Labor Council

**Jim Ross**, Safety Supervisor, Weyerhaeuser Co.

**Bill Little**, Financial Secretary,  
Lumber and Sawmill Workers Local 2767

**Rex Caffall III**, Risk and Safety Consultant, Caffall LLC

**Carl Bullock**, Safety Chair and IAM Local 536  
Union Representative, Weyerhaeuser Co.

We also thank those who volunteered their mills to serve as demonstration sites. Your participation has been crucial to the success of this project.

**Robert Andrews**, Aberdeen Lumber (Weyerhaeuser), Aberdeen

**Melvin Kern**, Caffall Brothers Forest Products, Longview

**Bob Lewis**, Columbia Vista Corporation, Vancouver

**John Glenn**, Glenn Custom Milling, Shelton

**Charlie Allen**, Mary's River Lumber Co, Montesano

## **Education Materials**

**Thank you!  
Team Participants**

**Thank you!  
Mill Managers**

## What Industry and Labor say about this Guidebook

# A Manual for & by the Industry

*"During the last several months I have had the opportunity to work with representatives from the Department of Labor & Industries, organized labor, and business leaders engaged in the sawmill industry in southwest Washington. Our mission was the development of a manual that would provide guidance for the sawmill industry in addressing ergonomic hazards for lumber handlers. I endorse the use of this manual. It represents the best collective ideas presently available for our industry to deal with work-related musculoskeletal disorders."*

**Bruce Scharen, January 2001**  
**Workers Compensation and Safety Manager**  
**TOC Management Services.**

*"This manual represents the culmination of months of work by a cross section of interested parties, including industry, labor, and the Department of Labor & Industries. It is an attempt to address work-related musculoskeletal disorders (WMSDs) in sawmilling and planing operations in the State of Washington, and is designed to give management and lumber workers an additional tool to protect those people in the industry most susceptible to this type of injury, i.e. "lumber handlers." I believe it achieves this goal and gives everyone, including some who may not have had previous access to such information, an opportunity to improve safety in their workplace."*

**Jim Ross**  
**Safety Process Leader**  
**Weyerhaeuser Co.**

*"I was asked to participate, as a labor representative (3rd District Vice President of the Washington State Labor Council, AFL-CIO and Vice President of WCIW Local 3099), in researching and finding solutions for the major causes of accidents in the Lumber Industry. The Hazard Impact Partnership, comprised of Business, Labor and the Dept. of Labor and Industries, sat down together, rolled up our sleeves and went to work on this project. We had ONE Goal...Reduce or eliminate the largest causes of injury in the Lumber Industry, work related Musculoskeletal Disorders for Lumber Handlers. We have, as Bruce Scharen mentioned, developed this first of its kind manual. After months of work, It is finished! I highly endorse this manual, it WILL help in the fight to eliminate or reduce injuries in your workplace."*

**Jim Neeley**  
**3<sup>rd</sup> District Vice President, Washington State Labor Council**

# Lumber Handlers

## Risks & Controls

This guide focuses on occupations that traditionally include manual handling of lumber during the process of converting logs into finished lumber. We refer to these jobs as lumber handlers. For the purposes of this manual, lumber handlers include:

- Machine off bearers
- Edger operators
- Resaw operators
- Straighteners/drop sorters
- Trim saw operators
- Planer operators
- Graders
- Pullers
- Banders

### Analyses of jobs for ergonomic risk factors included:

- On-site visits and observation of workers doing their jobs
- On-site measurements and videotaping
- Interviews with managers, supervisors and workers
- Analysis of video and digital images of work processes
- Detailed risk assessment using several documented tools including the Washington State Ergonomics Rule
- Solution findings
- Review by L&I staff, ergonomists, and professionals from the sawmill industry

Detailed reviews clarified the accuracy of findings and helped develop the lists of possible controls. It is recognized that one control does not fit all situations, and the listed controls represent a range of options that have worked in other sawmill settings. Mills are not limited to the controls listed in this manual and they may use others that effectively reduce hazards.

For each of these jobs this guide provides:

- A description of typical job tasks
- An assessment of the job physical demands
- When the job becomes hazardous based on “Appendix B” of the Washington State Ergonomics Rule
- Possible engineering controls, administrative controls, or work practice controls (for definition of the controls see glossary page 33)

**What jobs are covered in this guide?**

**How were the job analyses done?**

**One size doesn’t fit all.**

**What information is included?**



# Controlling Hazards

---

Controlling WMSD hazards in sawmills largely takes the form of interventions that reduce or eliminate the workers' handling of wood. Or they reduce the forces, repetitive movements, or awkward postures employees encounter as they guide wood through the mill.

It should be understood that many of the lumber handling issues in sawmills can be addressed "upstream," and that problems occurring at some stations can be controlled well before "that one" in the wood stream.

This section of the manual addresses the jobs of lumber handlers found in mills of low to moderate automation. Each job is described and then, in table form, the job is broken down into:

1. the risk factors associated with it
2. when exposure becomes potentially hazardous
3. a list of the possible controls that might be implemented to reduce the hazards

These controls are often the same controls that:

- reduce the disruption of the flow of wood through a sawmill
- present wood to machine centers spaced and straight
- reduce resaw
- separate slash from usable wood

## Rotation

Generally, people who work in sawmills are exposed to similar risk factors, making job rotation difficult. The guide to job rotation in sawmills on page 37 may be helpful in determining whether job rotation can be an effective control for your sawmill.

# Machine Off Bearer

The machine off bearer job is usually located between the headrig saw and the edger. This position ensures that cants are straightened, slab woods and slash are disposed of, and in some mills, ensures that the wane is up. Some mills automate this process. Cants can weigh up to 300 lbs.



## If the job requires...

bending and reaching to turn cants and remove trim and slash

lifting and turning cants

## If the job requires...

manually handling excessive slash and trim

## It becomes hazardous when...



the back is bent more than 30° more than 4 hours per day

OR



the back is bent more than 45° more than 2 hours per day

Hazard varies depending on the hand placement, frequency of lift and weight of the board (see Appendix B of the ergonomics rule)

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

OR

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard...

- Raise the chain to reduce the bending angle of the back (not applicable to large cants).
- Use a pike pole or pickaroon to remove trim and slash.
- Use mechanical board turners or reverse running chains with pneumatic driven pop-up pins or stops to flip boards.
- Use the momentum of the chain to assist with turning of cants.

## To control this hazard...

- Use a pike pole or pickaroon to remove trim and slash.
- Install a controlled gate stop on the headrig outfeed together with jump chains to direct materials.

continued

# Machine Off Bearer Continued

## If the job requires...

gripping large and heavy cants to turn them

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

**OR**

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard...

- Tilt the headrig saw to make sure the wane of the cants is up.
- Use mechanical board turners or reverse running chains with pneumatic driven pop-up pins or stops to flip boards.
- Create a ramp system to take cants up and allow trim to fall down. Chains may help to direct materials.
- When boards come from two different chains, or there is a drop from one chain to another, it is important to have a well-designed ramp so that boards are dropped properly and aligned to eliminate the extra physical effort to lift, straighten, and separate them.
- Install a steep un-scrambler which will help straighten and separate boards.
- Train the headrig worker to turn the log frequently and not cut past the center of the log before they flip it in order to ensure proper landing of the cants with the wane up.
- Use the momentum of the chain to assist with turning of cants.

# Machine Off Bearer Continued

## If the job requires...

gripping cants to separate, straighten or turn them  
*(such as in the case of two lines coming together and dropping boards on a lower chain, creating a pile up).*

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

**OR**

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard...

- Install a steep un-scrambler which will help straighten and separate boards. The following factors need to be considered:
  1. A steep un-scrambler will ensure picking up one board at a time.
  2. Ramps will reduce the likelihood of cross-ups after the un-scrambler.
  3. Metal cross bars on the un-scrambler will help to reduce the potential of cross-ups on the un-scrambler.

## If the job requires...

looking down at a monitor or control panel as in some automated production processes

## It becomes hazardous when...



the neck is bent more than 45° more than 4 hours per day without the ability to vary posture or support the head.

## To control this hazard...

- The control panels may be placed on an arm so that they can be moved in front of the worker.
- Position monitors and control panels to improve neck postures.

## Risk Factors Not Covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

standing for long periods

repetitively operating foot controls in awkward postures can cause lower extremity tendinitis

## To control

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles
- Use sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on
- Recess the foot control into floor to reduce upward (dorsi) flexion of the foot

# Edger Operator

Edging is a secondary breakdown process that makes longitudinal cuts in cants. It is located after the headrig saw. There the cants are broken down to boards then sorted and straightened. There are usually 3 major variations in the edging process:

1. an operator manually feeds the edger
2. an operator sits in a control booth and operates machines that feed the edger
3. a computerized edging process with an operator to monitor the production flow



## If the job requires...

(manual edger operator)

gripping cants to straighten them

lifting cants to align them

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

OR

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

The hazards vary depending on the hand placement, frequency and weight being lifted (see Appendix B of the ergonomics rule)

## To control this hazard...

- Raise the end feed table to make it higher than the roller and add adequate line bars with reversible chains
- Use a system of pop-up pins to align cants
- Use alignment and jump chains
- Use a line bar to straighten cants
- Install an adjustable fence
- Install an adjustable fence
- Install a surge chain with manual position
- Install an unscrambler with manual position
- Install an unscrambler with joy stick position of stop pins
- Install an unscrambler with pre-positioning pin stops
- Install a singulating unscrambler with optimizer auto position
- Install an unscrambler with waterfall and optimizer auto position
- Install an unscrambler with speed-up with optimizer auto position
- Install an unscrambler with speed-up and auto controls for singulating and positioning by optimizer

# Edger Operator Continued

## If the job requires... (control booth operator)

Gripping joysticks or other controls

looking down at a monitor  
or control panel as in some  
automated processes

## It becomes hazardous when...

It is done with a force greater  
than 10 pounds per hand with  
bent wrists for more than 3 hours  
per day



the neck is bent more  
than 45° more than 4  
hours per day

## To control this hazard...

- Place the control panels on an adjustable height swing-arm so that they can be moved in front of the worker
- Properly position monitors and control panels to improve neck postures
- Reconfigure the panel to make it adjustable for a variety of people

## Risk factors not covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

standing for long periods of time

repetitively operating foot controls in  
awkward postures can cause lower  
extremity tendinitis

## To control...

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles
- Use sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on

Recess the foot control into floor to  
reduce upward (dorsi) flexion of the foot

# Resaw Operator

The resaw operator's job is to further size boards as needed. Boards come in varied sizes depending on mills and processes. In most cases, conveyor chains are controlled by foot controls, but they may also be controlled by hand controls. Saws in the resaw process are positioned horizontally or vertically.



## If the job requires...

reaching above the head for the control panel

## It becomes hazardous when....

the hands are actually over the head for more than 4 hours per day

OR

raising the hands above the head more than once per minute, for a total of more than 4 hours per day.

## To control this hazard...

- Relocate the control panel to eliminate reaching up
- Make the control panel adjustable to improve working posture

## If the job requires...

gripping boards and feeding them into the saw

## It becomes hazardous when....

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

OR

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard...

- Automate the board feeding process with pin stops and the operator sitting in a booth
- Use speed up rollers to make sure boards are sent to the operator's position to help reduce reaching and gripforce on boards

## If the job requires...

lifting heavy boards especially during upset conditions when boards pile up

## It becomes hazardous when....

The hazard varies depending on the hand placement, frequency of lift and weight of the board (see Appendix B of the ergonomics rule)

## To control this hazard...

- Use unscrambler to straighten and pace boards.
- Install a v-notch unscrambler in limited space situations

# Resaw Operator Continued

## If the job requires...

bending to reach for boards

## It becomes hazardous when....



the back is bent more than 30° more than 4 hours per day



the back is bent more than 45° more than 2 hours per day

## To control this hazard...

- Automate the board feeding process with pins stops and the operator sitting in a booth
- Have an opening to allow the operator to get closer to the boards thus reducing the long reach while bending
- Train workers to wait to handle boards until they are closer to minimize reaching and bending
- Speed up rollers may be needed

## Risk factors not covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

Standing for long periods

- repetitively operating foot controls in awkward postures can cause lower extremity tendinitis

## To control...

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles
- Use sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on
- Recess the foot control into floor to reduce upward (dorsi) flexion of the foot



# Straightener/Drop Sorter

Lumber straighteners and drop-sorters usually work together. In some mills, these jobs may be called floaters or tipplemen. Lumber straighteners clear jam-ups on conveyors, unstack and straighten boards and dispose of debris. The drop sorter's main function is to sort boards and operate drop gates to send boards to the appropriate chains.



## If the job requires...

handling boards to straighten, sort or unstack them

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

**OR**

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard

- Install a functional unscrambler with metal cross bars that can help reduce pile up of boards
- The unscrambler capacity needs to be compatible with the board flow
- A deeper unscrambler is needed with high product flow conditions
- Adjust the angle of the slope of the unscrambler so the boards can be dropped down smoothly without cross-ups
- Install a short "V" notch type unscrambler when space is a concern (this can be installed in a 4-foot space)
- Install trim eliminator

## If the job requires...

lifting large and heavy boards during sorting

## It becomes hazardous when...

The hazards vary depending on hand placement, frequency of lift and weight of the board (see Appendix B of the ergonomics rule)

## To control this hazard

- Position the 2<sup>nd</sup> conveyor belt before the unscrambler to avoid cross-ups
- Place a picker on the edger out-feed to dispose of slash and trim

Continued

# Straightener/Drop-Sorter continued

## If the job requires...

bending and reaching for boards or slash

## If the job requires...

looking down at a monitor or control panel

## It becomes hazardous when...



the back is bent more than 30° more than 4 hours per day



the back is bent more than 45° more than 2 hours per day

## It becomes hazardous when...



the neck is bent more than 45° more than 4 hours per day without the ability to vary posture or support the head

- Install a computerized trim eliminator to get rid of trim at the edger. Space is needed to install such a device
- Place a chipping head on the edger
- Adjust the speeds of the conveyor chains to avoid pile ups
- Install mirrors to spot pile ups
- Make sure the number of operators is compatible with the product flow
- Train operators to handle boards only when necessary

## To control this hazard...

Move operators closer to the gate

## To control this hazard...

- The control panel may be placed on an articulating arm so that it can be moved in front of the worker
- Raise or tilt monitors and control panels to improve neck posture

## Risk factors not covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

standing for long periods

repetitively operating foot controls in awkward postures can cause lower extremity tendinitis

## To control...

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles

- Recess the foot control into floor to reduce upward (dorsi) flexion of the foot

- Use sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on

# Trim Saw Operator

The trimmer's main function is to trim ends of boards to length. Usually, the major activity of a trimsaw operator is to load lugs that carry boards into the saws. This job may be automated in some mills.



## If the job requires...

gripping boards to position them into lugs

gripping boards to position them for cuts

gripping boards to help straighten or separate them

gripping slash to manually dispose of it

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

**OR**

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard...

- Install a properly designed automatic lug feeder
- Add an extra powered belt for longer boards to assist with alignment
- Use a curved ramp after an unscrambler so boards coming off will be straight and separate
- Synchronize chains to prevent pile-ups
- Automate the process with electric eyes to know when to load more materials and to detect excess in order to prevent pile-ups
- Install a drop sorter before the trim saw to dispose of slash
- Increasing the space between the unscrambler and the operator may help reduce jam-ups. This space could actually serve as a buffer area
- Use a person to monitor back-ups so that no more boards will be sent to the trimmer than can be handled
- Teach the operator not to handle boards unnecessarily

# Trim Saw Operator Continued

## If the job requires...

bending to reach and align boards

lifting boards at jam ups

## It becomes hazardous when...



the back is bent more than 30° more than 4 hours per day



the back is bent more than 45° more than 2 hours per day

The hazard varies depending on the hand placement, frequency of lift and weight of the board (see Appendix B of the ergonomics rule)

## To control this hazard...

- Install functional even ending fences to align boards
- For workers who need to load lugs with stacked boards, it may be necessary to lift the chain and bring it back so that it comes underneath the horizontal chain, then lugs will take boards off and away
- Teach worker not to handle boards unnecessarily
- Properly control the chains to prevent pile-ups
- Use a person to monitor back ups so that no more boards will be sent to the trimmer than can be handled
- Install a drop sorter before the trim saw to dispose of slash

## Risk factors not covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

standing for long periods of time

repetitively operating foot controls in awkward postures can cause lower extremity tendinitis

## To control...

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles
- Use sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on

Recess the foot control into floor to reduce upward (dorsi) flexion of the foot

# Planer Operator

The planer operator loads boards into the planer machine. Foot and hand controls are usually used to advance chains and control the planer machine. This is usually the first process in a planer mill. Boards can come stacked together and the operator may need to remove boards from piles. For kiln-dried boards, stickers are used between the layers. The planer operator may also need to manually remove stickers. Most planer operations are similar with the major differences being the degree of the operator's intervention (automation). In some sawmills, the planer operator may also need to turn boards for inspection before feeding them into the planer machine.



## If the job requires...

reaching overhead to remove stickers

## If the job requires...

gripping boards to manually load them into the planer

gripping boards to move them from stacks

## It becomes hazardous when...

the hands are actually over the head for more than 4 hours per day

OR

it is done repetitively more than once per minute, more than 4 hours per day

## It becomes hazardous when....

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

OR

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard...

Develop a system that removes stickers before they are sent to the planer station

## To control this hazard...

- Install feed rollers at the planer machine to send the boards into the pineapple
- Install an un-scrambler to straighten and separate the boards
- An angled ramp after the unscrambler is an important consideration to ensure boards are dropped smoothly and not crossed up
- A “V” notch unscrambler may be appropriate for mills having limited space
- Adjust chain speed to ensure that boards do not pile up

Continued

# Planer Operator Continued

---

## If the job requires...

looking down at a monitor or control panel or to grade boards

## It becomes hazardous when....



the neck is bent more than 45° more than 4 hours per day without the ability to vary posture or support the head

## To control this hazard...

- Place the control panels on an adjustable height swing-arm so that they can be moved in front of the worker
- Raise monitors and control panels to improve neck postures

## Risk factors not covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

---

## If the job requires...

standing for long periods of time

## To control...

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles
- Provide sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on

# Grader

The grader's job can be found both in the sawmill and planer mill. Their main function is to grade boards of various dimensions and weights according to their quality. The job can be performed in either a seated or standing position. Where boards are chemically treated, grader operators are required to wear gloves during the operation.



## If the job requires...

gripping boards to turn them or send them to the resaw

## It becomes hazardous when ....

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

**OR**

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## To control this hazard...

- Use a mechanical board turning device with a lug loader
- Install a functional unscrambler to reduce board stacking
- Add another grader to reduce overall exposure to the risk

## Risk factors not covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

standing for long periods

## To control...

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles
- Provide sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on

# Puller

This job occurs later in the milling process in sawmills and planer mills. Boards are manually pulled off the conveyor chain and stacked by dimension for transportation. In larger mills, the process is often automated.



## If the job requires...

gripping and pulling boards to stack them

lifting boards to stack them

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

**OR**

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

Hazard varies depending on the hand placement, frequency of lifts and weight of the board (see Appendix B of the ergonomics rule)

## To control this hazard...

- Install a mechanical sorter and an auto stacker
- If boards are heavy, train workers to pull only one board at a time
- If thin boards are being handled (e.g. fence boards) several may be grasped at once. Train workers to put one hand underneath the load when lifting and carrying boards to reduce hand grip force
- Train workers to use the leverage of the boards and momentum during stacking (this will reduce the actual force on the hand during the lowering process of stacking)
- Use an auto stacker
- Use an adjustable height cart/bin or install a scissor lift to raise carts/bins to improve posture during lifting

Continued



# Puller Continued

## If the job requires...

bending to lower boards onto a cart during stacking

## It becomes hazardous when...



the back is bent more than 30° more than 4 hours per day



the back is bent more than 45° more than 2 hours per day

## To control this hazard...

- Install an auto stacker
- Use an adjustable height cart/bin or install a scissor lift to raise carts/bins

## If the job requires...

looking down at a control panel

## It becomes hazardous when...



the neck is bent more than 45° more than 4 hours per day without the ability to vary posture or support the head

## To control this hazard...

- The control panels may be placed on an adjustable arm so that they can be moved in front of the worker
- In an automated process, an adjustable chair should be used and workers trained in how to make proper adjustments

## Risk factors not covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

standing for long periods

## To control...

- Use anti-fatigue mats
- Use cushioning boot/shoe insoles
- Use sit/stand chairs or stools where applicable
- Install a horizontal bar or foot rail at 6 inches to rest one foot on

# Bander Operator

Bander operators band loads for transportation. This job is located at the end of the production. Often there are two bander operators working together, but one person may do this task. The worker may need to put tags on the ends of the loads using a staple gun, or by using a stencil for certain products. Sometimes loads need to be wrapped in plastic sheeting. This process could also be automated in some mills, where operator functions could be significantly different.



## If the job requires...

using your hand as a hammer to align boards.

## If the job requires...

gripping tools during banding operation.

## If the job requires...

bending to band the wood and/or wrap with plastic

## It becomes hazardous when...

it is done more than once per minute and more than 2 hours per day

## It becomes hazardous when...

it is done every few seconds with a grip force of more than 10 pounds per hand, more than 3 hours per day

OR

it is done every few seconds with a grip force of more than 10 pounds per hand, with *bent wrists* more than 2 hours per day

## It becomes hazardous when...



the back is bent more than 30° more than 4 hours per day



the back is bent more than 45° more than 2 hours per day

## To control this hazard...

- Use a rubber mallet
- Use an even end machine

## To control this hazard...

- Automate the process
- Rotate worker to jobs that don't include gripping
- Install a tool weight balancer if work station layout permits

## To control this hazard...

- Place the load on an adjustable height stand such as a scissors-lift or forklift tines to raise the height of the load being banded and wrapped

Continued

# Bander Operator Continued

## If the job requires...

using a chain saw to trim ends of boards

## It becomes hazardous when ...

Hazard varies depending on the vibration level of the saw and how long it is used (see Appendix B of the ergonomics rule)

## To control this hazard...

- Stay within the guidelines for time based on the vibration level of the saw
- Try well fitted anti-vibration gloves which are in compliance with ISO standard 1081.9

## If the job requires...

reaching above shoulder height to load the magazine

## It becomes hazardous when ...

it is done more than 4 hours per day

OR

raising the hands above the head more than once per minute for a total of more than 4 hours per day

## To control this hazard...

- Raise the loading area so that the operator does not have to feed it by reaching up
- Train the operator to wait to load the magazine at a lower level
- Elevate the workers so they can fill the magazine from a higher level, the battens must also be raised

## If the job requires...

repetitively firing a staple gun to place stickers on the ends of boards

## It becomes hazardous when ...

when it is done more than 6 hours per day

## To control this hazard...

- Work with the customers to develop a better labeling method to eliminate the repetitive firing of a staple gun
- Build or purchase an automatic labeling machine

## Risk Factors Not Covered by the Washington State Ergonomics Rule

*(Employers are not required to take action on risk factors not covered by the rule. You are encouraged, however, to minimize or eliminate them to reduce the potential for injury to workers.)*

## If the job requires...

Holding the staple gun in a fixed posture when stapling bar codes to ends of boards

## To control...

Use a tool balancer to suspend the staple gun, reducing the weight of the tool

# Resource Pages

---

The following pages are provided as a resource to help you prevent work-related musculoskeletal disorders (WMSDs).

**Ergonomic Awareness Education**

**Job Specific Training**

**Frequency of Injuries**

**A Quick Guide to Managing Claims**

**Core Ergonomic Principles**

**Glossary**

**Other Resources**

**L&I Service Centers**

**Ergonomics Rule & Appendices**

# Ergonomics Awareness Education

---

Part 1 of Washington State's ergonomics rule (WAC 296-62-051 describes the risk factors that identify "Caution Zone Jobs." These jobs may not be hazardous or require controls.

## **If Caution Zone Jobs are Found...**

If an employee works in or is assigned to a job that has been determined to be a "Caution Zone Job", three things must happen:

1. The employee and their supervisor must be given basic ergonomics awareness education within 30 calendar days of the determination or assignment to the job.
2. The employee and their supervisor must receive ergonomics awareness education every three years.
3. The job must be analyzed further with employee involvement to determine if there are hazards.

## **The following topics must be included in the education:**

- Information on work-related causes of musculoskeletal disorders, including all caution zone risk factors listed in the rule (non-work factors may be included as well);
- The types, symptoms and consequences of WMSDs and the importance of early reporting;
- Information on identifying WMSD hazards and common measures to reduce them;
- The requirements of the Washington state ergonomics rule.

## **Where to access free ergonomic awareness education:**

The Department of Labor and Industries offers free materials to help employers comply with the ergonomic awareness education requirement of Washington State's ergonomics rule.

1. An Internet-based PowerPoint presentation, including instructor's guide. Visit <http://www.LNI.wa.gov/wisha/ergo> and click on Ergonomics Rule Slide Presentations.
2. You should have received a CD with this manual. The CD contains a PowerPoint presentation you may use to educate employees who work in Caution Zone Jobs. If you did not receive the CD you can get one by calling (360) 902-5452.

# Job-specific Training

---

Caution Zone jobs must be analyzed to determine whether exposure reaches hazardous levels. If this analysis shows that a Caution Zone Job is hazardous, and if reducing the hazard includes changes in the job or work practices, then job-specific training must be provided. This job-specific training must include:

1. The hazards of the work activities
2. Safe work practices
3. The details of specific measures that have been implemented to reduce WMSD hazards
4. Training in how to use new or improved equipment, processes, or steps in processes

# Frequency of Injuries

Each year, work-related musculoskeletal disorders (WMSDs) result in 50,000 workers’ compensation claims in the State of Washington. The direct cost of these claims average \$410 million in medical treatment and time-loss payments. From 1991 to 1999, the sawmill industry in Washington State experienced 6,948 claims for WMSDs.

A WMSD is an injury such as back strain, tendinitis or carpal-tunnel syndrome. These are injuries that happen over time due to repeated motions or awkward postures that the human body was not designed to do.

Over 50,000 WMSD  
Claims Each Year

Direct Costs of  
\$410 Million in Losses

This chart summarizes the type and frequency of non-traumatic soft tissue WMSDs affecting sawmill lumber handlers during the period 1991 through 1999:

	SW WA <sup>1</sup>	Demo Mills <sup>2</sup>	Other SW WA <sup>3</sup>	Statewide <sup>4</sup>
Neck, Upper Extremity & Back	1841	297	1544	3523
Back	906	143	763	1792
Shoulder	259	34	225	457
Elbow / Forearm	113	18	95	246
Carpal Tunnel Syndrome	146	16	130	242
Hand / Wrist / Finger	387	69	318	688

Notes:

- <sup>1</sup>**SW WA:** all State Fund Insured sawmill accounts identified in Southwest Washington
- <sup>2</sup>**Demo Mills:** the four Southwest Washington State Fund Insured sawmills in the demonstration project
- <sup>3</sup>**Other Region 4:** Southwest Washington State Fund sawmill accounts NOT included in the demonstration project
- <sup>4</sup>**Statewide:** Sawmill SIC (Standard Industrial Code) statewide

# A Quick Guide to Managing Claims

Claims Management is an essential part of controlling your workers' compensation costs. A proactive approach will make claims and claim costs much easier to manage. Claims Management includes all policies and activities necessary to monitor, communicate and control costs associated with workers' compensation claims. Here are a few tools and procedures to help you in monitoring and managing your workers' compensation claims. These policies should be included in your employee orientation.

## Claims Management

A written policy outlines both management and employee expectations and responsibilities regarding claims. This policy can help avoid confusion and lengthy claims, which contribute to higher insurance rates.

### ***This policy should include:***

- ✓ Training for all employees, including supervisors, on the claims process (include in Employee Orientation)
- ✓ An established position as the point of contact for the company's claims
- ✓ Accident reporting procedures
- ✓ Tracking and monitoring system for claims activities (individual files should be kept for each claim)
- ✓ Communication procedures between all parties (L&I, injured worker, vocational counselor, medical provider, supervisor and the point of contact person for the company)

## Return-To-Work

A written Return to Work (RTW) policy can guide the employer and injured worker through the process of returning to work after an injury. A proactive approach can help avoid unnecessary time loss and lost productivity.

### ***This policy should include:***

- ✓ Training for all employees, including supervisors, on the RTW process (include in Employee Orientation)
- ✓ An established position as the point of contact for the RTW activities (should be the same person handling claims information)
- ✓ Written job descriptions or job analyses, including physical requirements, for all jobs in your company
- ✓ Identified job tasks for transitional/light-duty work opportunities and written descriptions of the tasks, including physical requirements

## Claims Management

## Return-To-Work



**If you would like more help, please contact your local Risk Management Specialist.**

Region 1	Everett	(425) 290-1363
Region 2	Bellevue	(425) 990-1456
Region 3	Tacoma	(253) 596-3874
Region 4	Tumwater	(360) 902-4837
Region 5	Yakima	(509) 454-3754
Region 6	Spokane	(509) 324-2581

# Core Ergonomic Principles

1. Adapt the work space and the work equipment to take into account the stature of the operator and the kind of work being performed with preferred body postures, namely trunk erect, body weight appropriately supported, elbows at the side of the body and forearms approximately horizontal
2. Provide sufficient space for body movements, especially the head, arms, hands, legs and feet
3. Provide variety in tasks and movements to avoid static muscle tension caused by postural constraints
4. Design work to allow machinery to do or assist with highly repetitive tasks; leave more variable tasks to human operators
5. Put controls within functional reach. Grips and handles need to suit the functional anatomy of the hand
6. Keep loads close to the body and handle with neutral postures
7. Keep strength demands compatible with the physical capacities of the worker
8. Use mechanical assistance if strength demands exceed the capacity of muscle groups
9. Use larger muscle groups for higher forces, smaller muscle groups for precision work
10. Do not combine requirements for great accuracy and strength on the same job at the same time
11. Avoid extreme postures when exerting high force
12. Design tasks to permit gripping with the fingers and the palm instead of pinching
13. Reduce hand-arm vibration hazards from using power tools by reducing the tool's vibration intensity, reducing exposure time, or isolating the individual from the vibration
14. Provide adjustable equipment, workstations, tools

*Adapted from International Standards Organization 6385: Ergonomic principles in the design of work systems, 1981; Salvendy 1994; Sanders and McCormick 1987; Ergonomic Design for People at Work by Eastman Kodak, Rodgers et al. 1986*

# Glossary

**Administrative controls:**

Management determined policies which reduce worker exposure to risk factors by making changes to the worker's job tasks, through measures such as:

- job rotation
- increasing break frequency or duration
- broadening or varying the employee's tasks
- changing shift length or reducing overtime

**Awkward posture:** deviation from the neutral positions of the different body parts. Awkward postures typically include reaching above, behind, twisting, forward or backward bending, pinching, squatting, and kneeling.

**Carpal tunnel syndrome:** inflammation due to high compression of the median nerve as it passes through the carpal tunnel in the heel of the hand.

**Caution zone jobs:** jobs where an employee's typical work activities include any of the specific physical risk factors identified in WAC 296-62-05105. These jobs have a sufficient degree of risk to require ergonomics awareness education and job hazard analysis.

**Caution zone and hazard analysis:** A method of analyzing workstations and jobs for risk factors listed in the Washington State Ergonomics Rule to determine if a job is in the hazard or caution zone. Employers can use:

- the Caution Zone Checksheet (page 3 of the rule) and Appendix B,
- the tools listed in the General or Specific performance approach (pages 5&6 of the rule), or
- tools they are currently using if they are as effective as those listed in the rule to determine risk.

**Engineering controls:** Developing or modifying tools, machinery, workstations and/or materials, and product designs to reduce worker exposure to risk factors. Engineering controls more effectively reduce or eliminate the hazard, and therefore are generally preferred.

**Ergonomics:** the science and practice of designing jobs or workplaces to match the capabilities and limitations of the human body. It is the scientific study of human work. The term comes from the Greek words "ergos" meaning work, and "nomos," meaning natural laws of. Ergonomics considers the physical and mental capabilities and limits

Continued

of the worker as he or she interacts with tools, equipment, work methods, tasks, and the working environment.

**Fatigue:** a condition that results when the body cannot provide enough energy for the muscles to perform a task.

**Force:** the amount of physical effort a person uses to do a task.

**Full time equivalent (FTE):** The equivalent of one person working full-time for one year (2000 worker hours per year). For example, two persons working half time count as one FTE.

**Hand-arm vibration:** vibration (generally from a powered hand tool) that goes through the hand, and then travels through the rest of the arm.

**Hazard prevention and control:** eliminating or minimizing the hazards identified in the worksite analysis. It is changing the jobs, workstations, tools or environment, work organization or work practices to fit the worker. Hazard prevention and control is an element of an ergonomics program.

**Neutral posture:** Recommended working posture in which joint angles do not contribute to excessive stress on the body. For example, when standing, the head is aligned over shoulders, shoulders aligned over hips, hips aligned over ankles, and elbows are at the side of the body.

**Personal protective equipment:** gloves, kneepads and other equipment that may help reduce the impact of the hazards to the operator. These can be implemented to supplement existing controls.

**PPE:** an acronym for personal protective equipment (see above).

**Repetition:** performing the same motions over and over again. The severity of risk depends on the frequency of repetition, speed of the movement or action, the number of muscle groups involved, and the required force.

**Risk factors:** an aspect of a job that increases the worker's chance of developing a work-related musculoskeletal disorder. Risk factors include: awkward postures, high hand force, highly repetitive motion, repeated impact of the hand or knee, heavy, frequent or awkward lifting, and moderate to high hand-arm vibration.

**Work practice controls:** Management determined work practices and policies including specific *training* in:

- work processes (for example, two person lifting in certain circumstances) or
- machinery or tool use designed to reduce or prevent exposures to physical risk factors. Work practice controls usually contain some element of behavior change of the operators.

**Work-related musculoskeletal disorders (WMSDs):**

Work-related disorders that involve soft tissues such as muscles, tendons, ligaments, joints, blood vessels and nerves. They are caused or made worse by forceful or repetitive exertions, particularly in combination with awkward postures or vibration. Examples include: Muscle strains and tears, ligament sprains, joint and tendon inflammation, pinched nerves, degeneration of spinal discs, carpal tunnel syndrome, tendinitis, and rotator cuff syndrome. For purposes of this guide and the ergonomics rule, WMSDs do not include injuries from slips, trips, falls, motor vehicle accidents or being struck by or caught in objects.

# Other Resources

---

## **L & I Safety and Health Video Library**

The Department of Labor and Industries operates a video library to help employers and employees learn more about workplace safety and health. The collection includes videos on ergonomics. Setting up an account and borrowing videos is free; the only cost is return shipping by a traceable carrier (e.g., Federal Express, United Parcel Services) or through the U.S. Postal Service's Registered Mail. For more information on setting up an account, call 800-574-9881 or visit [www.LNI.wa.gov/wisha/videocat/index.htm](http://www.LNI.wa.gov/wisha/videocat/index.htm).

[www.Lni.wa.gov/wisha/videocat](http://www.Lni.wa.gov/wisha/videocat)

## **L & I Ergonomics web site**

Visit L&I's ergonomics Web site for more information about Washington State's ergonomics rule and L&I's educational resources on ergonomics, including useful tools to help you comply with the rule.

[www.Lni.wa.gov/wisha/ergo](http://www.Lni.wa.gov/wisha/ergo)

## **Ergonomics related links**

L&I's ergonomics Web site also includes links to other Web sites that have useful information and resources on ergonomics.

[www.ergoweb.com](http://www.ergoweb.com)  
[www.Lni.wa.gov/wisha/ergo/ergolinks](http://www.Lni.wa.gov/wisha/ergo/ergolinks)

## **Research reports on WMSD**

L&I's Safety and Health Assessment and Research for Prevention (SHARP) Program has published more than 25 research reports realting to work related musculoskeletal disorders and ergonomics issues in certain industries.

[www.Lni.wa.gov/sharp](http://www.Lni.wa.gov/sharp)

# Job Rotation

---

This information is included in this manual as a guide, and possible resource for you in case you have jobs that meet the criteria for rotation in your mill.

Job rotation in a manufacturing environment is designed to limit employee exposure to risk factors so as to reduce their potential for developing work related musculoskeletal disorders (WMSDs). However, implementing job rotation in a sawmill can prove difficult. Many jobs require very specific skills and performing them competently takes months of training and practice (for example, headrig operator or grader). Other jobs require different skills, but, because many have similar risk factors, effective job rotation may not be possible.

## Goal of Job Rotation

The primary goal of job rotation is to allow muscle-tendon groups that would be overloaded by a set of tasks enough time to recover from the overload. Adequate training and break-in periods are important for all employees in a job rotation program. This also suggests that the number of jobs included in a particular rotation should be kept to a minimum, perhaps two or three, allowing the employees to become “experts” at each task. It is important not to have employees rotate into jobs they cannot perform.

## Practical Implications of Job Rotation

Job rotation does not change the risk factors present in a facility. It only distributes the risk factors more evenly across a larger group of people. So within a job rotation, the intent is to reduce the risk factors below the hazard level for certain jobs. ***It is important to understand that if your business does not have jobs that differ significantly from one another in their risk factors, the benefit of a job rotation scheme could be limited.***

## Example of a Job Rotation Scheme

The table on page 38 shows the risk factors for three typical jobs in a sawmill. Exposure to a risk factor will occur in only a percentage of the total shift. In example, an edger who works an eight-hour shift grips large cants with a grip force of more than 10 pounds per hand for about half of each cycle (advancing cant, grasping cant, straightening cant, releasing cant) his or her actual exposure would be close to four hours or 50% of the total time on shift. To assure that he/she doesn't enter the hazard zone, the edger could rotate with the bander and/or the puller for part of the shift to insure the hand force risk was below hazard level, assuming that the bander operator and puller are not exposed to high hand force. It is important to keep in mind that though the employee is working at a job for eight hours, they probably will be exposed to a risk factor for only a percentage of the time, which is determined by job analysis.

If the edger rotates with the puller or the bander for half the shift, he or she will then have half the exposure to the risk factors in the edging job. Since in the edging job, he or she is gripping only half of each cycle (grasping cant, straightening, releasing), or half of four hours, then their total exposure to the risk factor is two hours, which is clearly in or below the caution zone.

## Possible Two Or Three Job Rotation In A Sawmill

Job	Activity	Potential hazard(s)	Rotation
<b>Bander</b>	Using a manual banding machine to cinch up loads of boards.	<b>Highly repetitive motions</b> to cinch up the bands on loads of boards. Becomes a hazard if done every few seconds for 6 hours. If done with a force of 10 pounds per hand and in awkward wrist position, it becomes a hazard at 2 hours.	Rotate with Edger <b>and</b> Puller on a schedule reduces actual exposure to the risk to 2.6 hours.  Rotate with Edger <b>or</b> Puller on a schedule reduces actual exposure to the risk to 4 hours.
<b>Edger</b>	Gripping large cants to hold and position them against resistance for passage through edger.	Applying <b>high hand force (gripping)</b> . This is hazardous if gripping for more than 4 hours total. If done every few seconds, the hazard level drops to 3 hours. If done every few seconds and in awkward wrist posture, the hazard level drops to 2 hours.	Rotate with Bander <b>and</b> Puller on a schedule reduces actual exposure to the risk to 2.6 hours.  Rotate with Bander <b>or</b> Puller on a schedule reduces actual exposure to the risk to 4 hours.
<b>Puller</b>	Tasks include pulling boards from green chain and stacking them on platforms.	Hazardous for <b>awkward postures</b> when back is bent forward 30° more than 4 hours per day, or more than 45° for more than 2 hours per day. The <b>lifting</b> hazard can be determined by using the lifting calculator in Appendix B of the rule to determine the weight of the object, the frequency of the lifts and how many hours the lifting is done per day.	Rotate with Edger <b>and</b> Bander on a schedule reduces actual exposure to the risk to 2.6 hours.  Rotate with Edger <b>or</b> Bander on a schedule reduces actual exposure to the risk to 4 hours.

With three-job rotation, each employee is reduced to a total of 2.6 hours exposure at each job, keeping them well within the permissible exposure limits (Caution Zone) for each job. In this example, the three jobs in the rotation have different risk factors. If the jobs had similar risk then the benefit of WMSD risk reduction would be lost and rotation among those jobs would be inappropriate. However, though not ideal, rotating people into jobs that have the same risk factors, but less exposure to them, can have a beneficial effect by at least reducing the exposure to those at high risk. An example might be in a sawmill where lumber pullers pull and stack finished boards. Those pulling a greater volume of boards, or larger dimension boards, can be rotated with those who pull fewer boards or boards of smaller dimension. Jobs best able to benefit from job rotation are those of a dynamic character, which require real variation in muscular load.



## Cautions

Caution must be taken in the design of job rotation programs since poorly designed job rotation may increase worker physical stress levels. It is possible that rotating employees through physically stressful jobs may, given enough time, produce disorders in the entire group. Thus, the choice of jobs to be rotated between is extremely important.

Job rotation does not improve the job itself. Thus, it is vital to continue efforts to change the physical make-up of the jobs. Although job rotation may have beneficial effects of stress reduction and muscle/tendon group variation, engineering changes should remain the goal of the ergonomics plan.

## Steps of Rotation

1. Determine if you have jobs that are different enough to be able to employ job rotation.
2. Determine if:
  - the logistics of the proposed rotation are suitable
  - the job rotation seems reasonable
  - the list of job rotations has the affected employees approval
3. Provide employees with any training that is required for any new tasks performed or equipment handled.
4. Provide employees with adequate break-in time to ensure that they are fully qualified and physically conditioned to perform their new tasks.
5. Monitor the new rotation to see if employees are having difficulty performing new tasks.
6. Hold follow-up meetings with employees to evaluate the job rotation success.
7. Track other measures such as injury rates, turnover, employee satisfaction, or workers compensation to determine effects of the job rotation.

## How Often Jobs are Rotated

In most cases, the Washington State Ergonomics Rule's Appendix B defines a hazardous job to have exposure greater than four hours. For certain tasks, such as working with the back severely bent, the time limit is lower (to learn more about hazardous exposures of different duration, see Appendix B of the rule). In order to reduce exposure comfortably under the hazard threshold, the ideal rotation would be three jobs. However, it could be done using two jobs (a fifteen minute break in a two person rotation of four hours would drop the exposure to 3 hours and 45 minutes).

## Track the Program

Before you start the rotation, determine a baseline of the number of WMSDs, restricted duty days, and lost time by hours worked. Check employees' responses to the rotation scheme periodically. Gather follow up information on the data points listed above after an appropriate period of time (6 months to 1 year). Compare the data.

## Pros and Cons of Job Rotation

The small number of studies on job rotation have noted the following outcomes:

### ***Positive Outcomes Reported***

- Reduced boredom
- Reduced work stress
- Increased innovation
- Increased free time activity
- Reduced WMSDs
- Increased production
- Reduced absenteeism
- Reduced turnover

### ***Negative Outcomes Reported***

- Experienced workers not wanting to learn new types of work
- Machine operators not wanting to "lend" their machines to others
- Practical problems of physically getting from one job to the next
- Education and training of workers for new jobs
- Unsuitable wage forms
- Difficulties in finding appropriate jobs to rotate to
- Inappropriate use of job rotation by management

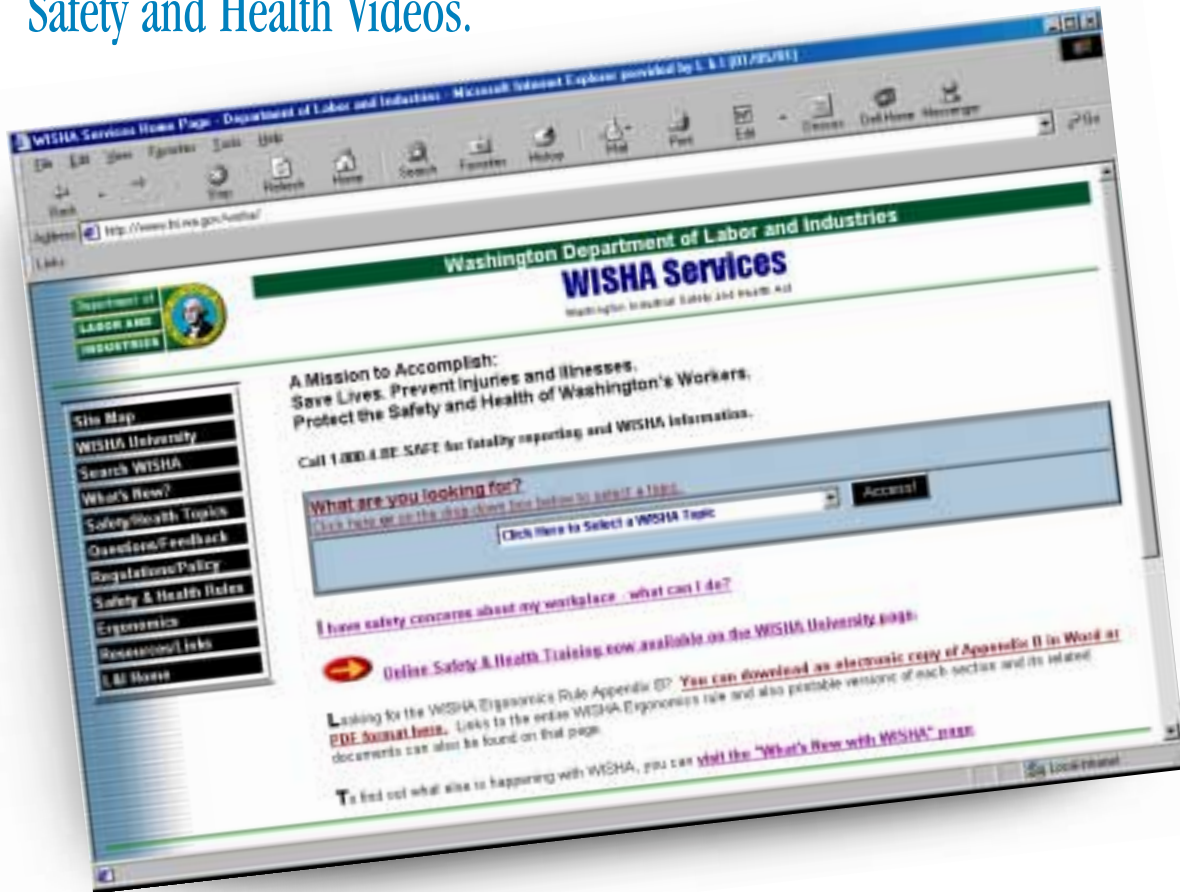
## Job Rotation References

---

1. Sven-Åke Axelsson and Bengt Pontén, New Ergonomic Problems in Mechanized Logging Operations, *International Journal of Industrial Ergonomics*, 5 (1990) pp. 267-273
2. Steven A. Lavender, The Development of Preparatory Response Strategies in Anticipation of Sudden Loading of the Torso, *Proceedings of the Human Factors Society 34th Annual Meeting* (1990), pp. 757-761
3. Bengt Jonsson, MD, Electromyographic Studies of Job Rotation, *Scand J Work Environ Health* 14 (1988): suppl 1, pp. 108-109
4. Putz-Anderson, V., 1988, *Cumulative Trauma Disorders - A Manual for Musculoskeletal Diseases of the Upper Limbs*, (London: Taylor & Francis), p. 83.
5. Lance Hazzard, Joe Mautz, Denver Wrightsman, Job Rotation Cuts Cumulative Trauma Cases, *Personnel Journal* v71n2 (Feb. 1992), pp. 29-32
6. Chris J. Henderson, Ergonomic Job Rotation in Poultry Processing, *Advances in Industrial Ergonomics and Safety IV* (1992), pp. 443-450
7. UFCW Office of Occupational Safety and Health, August 1989, *Analyzing Ergonomic Programs: Making Sure They Are the Real Thing*, (Washington, D.C.), pp. 3-4.
8. <http://www.danmacleod.com/job.htm> This website provides detailed guidelines for job rotation for ergonomic purposes.

# Come to the Source!

Information on Safety and Health Standards, Ergonomics, WISHA Guidelines, Hazard Alerts, Training Workshops, Proposed Rule Changes, Safety and Health Videos.



Labor & Industries WISHA Website has the Answers.  
Point and Click to Thousands of Pages of  
Valuable Information.

**www.Lni.wa.gov/wisha**

You can print additional copies of this publication and others directly from the website.

# Department of Labor and Industries Regional Service Centers



## **Aberdeen**

(360) 533-8200  
FAX: (360) 533-8220  
TDD: (360) 533-9336  
415 West Wishkah, Suite 1B  
Aberdeen, WA 98520-0013

## **Bellevue**

(425) 990-1400  
FAX: (425) 990-1446  
TDD: (425) 990-1450  
616 120th Avenue NE,  
Suite C201  
Bellevue, WA 98005-3037

## **Bellingham**

(360) 647-7300  
FAX: 647-7310  
TDD: (360) 647-7299  
1720 Ellis Street, Suite 200  
Bellingham, WA 98225-4600

## **Bremerton**

(360) 415-4000  
FAX: (360) 415-4048  
TDD: (360) 415-4014  
500 Pacific Avenue, Suite 400  
Bremerton, WA 98337-1943

## **Colville**

(509) 684-7417  
Toll-free 1-800-509-9174  
FAX (509) 684-7416  
298 South Main, Suite 203  
Colville, WA 99114-2416

## **East Wenatchee**

(509) 886-6500  
or 1-800-292-5920  
FAX: (509) 886-6510  
TDD: (509) 886-6512  
519 Grant Road  
East Wenatchee, WA  
98802-5459

## **Everett**

(425) 290-1300  
FAX: (425) 290-1399  
TDD: (425) 290-1407  
729 100th St. S.E.  
Everett WA 98208-3727

## **Kennewick**

(509) 735-0100 or  
Toll-free 1-800-547-9411  
FAX: (509) 735-0120  
TDD: (509) 735-0146  
4310 W 24th Ave  
Kennewick, WA 99338

## **Longview**

(360) 575-6900  
FAX: (360) 575-6918  
TDD: (360) 575-6921  
900 Ocean Beach Hwy  
Longview, WA 98632-4013

## **Moses Lake**

(509) 764-6900  
Claims/Industrial insurance -  
(509) 764-6913  
Electrical - (509) 764-6900  
FAX: (509) 764-6923  
TDD: (509) 754-6030  
3001 W. Broadway Ave.  
Moses Lake, WA 98837-2907

## **Mount Vernon**

(360) 416-3000  
FAX: (360) 416-3030  
TDD: (360) 416-3072  
525 E College Way, Suite H  
Mount Vernon, WA 98273-5500

## **Okanogan**

(509) 826-7345  
FAX: (509) 826-7349  
TDD: (509) 826-7370  
1234 2nd Avenue S  
Okanogan, WA 98840-9723

## **Port Angeles**

(360) 417-2700  
FAX: (360) 417-2733  
TDD: (360) 417-2752  
1605 East Front Street, Suite C  
Port Angeles, WA 98362-4628

## **Pullman**

(509) 334-5296  
Toll-free 1-800-509-0025  
FAX: (509) 334-3417  
1250 Bishop Blvd SE, Suite G  
PO Box 847  
Pullman, WA 99163-0847

Continued

**Seattle**

(206) 281-5400  
FAX: (206) 281-5529  
TDD: (206) 281-5528  
300 W Harrison Street  
Seattle, WA 98119-4081

**Spokane**

(509) 324-2600  
Toll-free: 1-800-509-8847  
FAX: (509) 324-2601  
TDD: (509) 324-2653  
901 N Monroe Street, Suite 100  
Spokane, WA 99201-2149

**Tacoma**

(253) 596-3800  
FAX: (253) 596-3956  
TDD: (253) 596-3887  
950 Broadway, Suite 200  
Tacoma, WA 98402-4453

**Tukwila**

(206) 835-1000  
FAX: (206) 835-1099  
TDD: (206) 835-1102  
PO Box 69050  
12806 Gateway Drive  
Seattle, WA 98168-1050

**Tumwater**

(360) 902-5799  
FAX: (360) 902-5792  
TDD: (360) 902-4637  
1st Floor, Lobby  
Mailing address: PO Box 44851  
Olympia, WA 98504-4851  
Physical address: 7273  
Linderson Way SW  
Tumwater, WA 98501-5414

**Please note:** The physical address for our Tumwater building is not for U.S. Postal Service mail (unless specifically requested by USPS). Using this address may significantly delay delivery

**Vancouver**

(360) 896-2300  
FAX: (360) 896-2345  
TDD: (360) 896-2304  
312 SE Stonemill Dr, Suite 120  
Vancouver, WA 98684-3508

**Walla Walla**

(509) 527-4437  
FAX: (509) 527-4486  
TDD: (509) 527-4172  
1815 Portland Avenue, Suite 2  
Walla Walla, WA 99362-2246

**Yakima**

(509) 454-3700  
Toll-free 1-800-354-5423  
FAX: (509) 454-3710  
TDD: (509) 454-3741  
15 W. Yakima Avenue, Suite 100  
Yakima, WA 98902-3401

# WAC 296-62-051, Ergonomics

## Part 1

### WAC

- 296-62-05101 What is the purpose of this rule?
- 296-62-05103 Which employers are covered by this rule?
- 296-62-05105 What is a “caution zone job”?

## Part 2

### WAC

- 296-62-05110 When do employers’ existing ergonomics activities comply with this rule?
- 296-62-05120 Which employees must receive ergonomics awareness education and when?
- 296-62-05122 What must be included in ergonomics awareness education?
- 296-62-05130 What options do employers have for analyzing and reducing WMSD hazards?
- 296-62-05140 How must employees be kept involved and informed?
- 296-62-05150 How are terms and phrases used in this rule?

## Part 3

### WAC

- 296-62-05160 When must employers comply with this rule?
- Note Help for employers in implementing the rule.

## Appendices

### WAC

- 296-62-05172 Appendix A: Illustrations of physical risk factors.
- 296-62-05174 Appendix B: Criteria for analyzing and reducing WMSD hazards for employers who choose the Specific Performance Approach.
- 296-62-05176 Appendix C: Standard Industry Classification (SIC) codes.

# PART 1

## **WAC 296-62-05101 What is the purpose of this rule?**

The purpose of this rule is to reduce employee exposure to specific workplace hazards that can cause or aggravate work-related musculoskeletal disorders (WMSDs). In workplaces where these hazards exist, employers must reduce them. Doing so will prevent WMSDs such as tendinitis, carpal tunnel syndrome and low back disorders. The rule is not designed to prevent injuries from slips, trips, falls, motor vehicle accidents or being struck by or caught in objects.

### **This rule contains three parts.**

- Part 1, WAC 296-62-05105, provides a quick way for employers to know if they are covered.
- Part 2 requires covered employers to meet an employee-education requirement and identify WMSD hazards. If hazards exist, the employer must reduce them.
- Part 3 shows covered employers when they must comply with this rule. An employer's type of business and number of employees determine how much time is permitted for compliance (3 to 6 years for fixing WMSD hazards).

The rule does not include any requirements for the medical management of WMSDs or change any requirements for handling industrial insurance claims. An employer will not be in violation of this rule solely because an employee develops a WMSD or related symptom.

## **WAC 296-62-05103 Which employers are covered by this rule?**

Employers with "caution zone jobs" are covered by this rule. A "caution zone job" is a job where an employee's typical work activities include any of the specific physical risk factors listed in WAC 296-62-05105.

## WAC 296-62-05105 What is a “caution zone job”?

### “Caution zone”

A “caution zone job” is a job where an employee’s typical work activities include any of the specific physical risk factors listed below. Typical work activities are those that are a regular and foreseeable part of the job and occur on more than one day per week, and more frequently than one week per year.

- Employers having one or more “caution zone jobs” must comply with Part 2 of this rule.  
“Caution zone jobs” may not be hazardous, but do require further evaluation.
- This rule does not prohibit “caution zone jobs.”
- Employers who have made a reasonable determination that they do not have “caution zone jobs” are not covered by this rule.
- Duration (for example, 2 hours) refers to the total amount of time per day employees are exposed to the risk factor, not how long they spend performing the work activity that includes the risk factor.

### Awkward Posture

- (1) Working with the hand(s) above the head, or the elbow(s) above the shoulder, more than 2 hours total per day
- (2) Working with the neck or back bent more than 30 degrees (without support and without the ability to vary posture) more than 2 hours total per day
- (3) Squatting more than 2 hours total per day
- (4) Kneeling more than 2 hours total per day

### High Hand Force

- (5) Pinching an unsupported object(s) weighing 2 or more pounds per hand, or pinching with a force of 4 or more pounds per hand, more than 2 hours total per day (comparable to pinching half a ream of paper)
- (6) Gripping an unsupported object(s) weighing 10 or more pounds per hand, or gripping with a force of 10 or more pounds per hand, more than 2 hours total per day (comparable to clamping light duty automotive jumper cables onto a battery)

### Highly Repetitive Motion

- (7) Repeating the same motion with the neck, shoulders, elbows, wrists, or hands (excluding keying activities) with little or no variation every few seconds more than 2 hours total per day
- (8) Performing intensive keying more than 4 hours total per day

### Repeated Impact

- (9) Using the hand (heel/base of palm) or knee as a hammer more than 10 times per hour more than 2 hours total per day

### Heavy, Frequent or Awkward Lifting

- (10) Lifting objects weighing more than 75 pounds once per day or more than 55 pounds more than 10 times per day
- (11) Lifting objects weighing more than 10 pounds if done more than twice per minute more than 2 hours total per day
- (12) Lifting objects weighing more than 25 pounds above the shoulders, below the knees or at arms length more than 25 times per day

### Moderate to High Hand-Arm Vibration

- (13) Using impact wrenches, carpet strippers, chain saws, percussive tools (jack hammers, scalers, riveting or chipping hammers) or other hand tools that typically have high vibration levels more than 30 minutes total per day
- (14) Using grinders, sanders, jig saws or other hand tools that typically have moderate vibration levels more than 2 hours total per day

(Employers may assume that hand tools vibrating less than 2.5 meters per second squared (m/s<sup>2</sup>) eight-hour equivalent are not covered.)



## PART 2

### **WAC 296-62-05110 When do employers' existing ergonomics activities comply with this rule?**

Employers may continue to use effective alternative methods established before this rule's adoption date. If used, the employer must be able to demonstrate that the alternative methods, taken as a whole, are as effective as the requirements of this rule in reducing the WMSD hazards of each job and providing for employee education, training and participation.

### **WAC 296-62-05120 Which employees must receive ergonomics awareness education and when?**

- (1) Employers must ensure that all employees working in or supervising "caution zone jobs" receive ergonomics awareness education at least once every three years. The employer may provide ergonomics awareness education or may rely on education provided by another employer or organization. Ergonomics awareness education materials provided by the department of labor and industries may be used to meet these requirements.
- (2) When employees are assigned to work in or supervise "caution zone jobs," they must receive ergonomics awareness education within 30 calendar days, unless they have received it in the past three years. This requirement applies when the initial "awareness education" deadline in the implementation schedule (WAC 296-62-05160) has passed.

### **WAC 296-62-05122 What must be included in ergonomics awareness education?**

Ergonomics awareness education (for example: Oral presentations, videos, computer-based presentations, or written materials with discussion) must include:

- Information on work-related causes of musculoskeletal disorders, including all caution zone risk factors listed in WAC 296-62-05105 (nonwork factors may be included as well);
- The types, symptoms and consequences of WMSDs and the importance of early reporting;
- Information on identifying WMSD hazards and common measures to reduce them; and
- The requirements of this ergonomics rule.

## WAC 296-62-05130

### What options do employers have for analyzing and reducing WMSD hazards?

All covered employers must determine whether “caution zone jobs” have WMSD hazards and must reduce the WMSD hazards identified as described below.

Employers may choose either the General Performance Approach or the Specific Performance Approach as follows:

<b>WAC 296-62-05130 - Analyzing and reducing WMSD hazards: General Performance Approach</b>	<b>WAC 296-62-05130 - Analyzing and reducing WMSD hazards: Specific Performance Approach</b>
(1) The employer must analyze “caution zone jobs” to identify those with WMSD hazards that must be reduced. A WMSD hazard is a physical risk factor that by itself or in combination with other physical risk factors has a sufficient level of intensity, duration or frequency to cause a substantial risk of WMSDs. The employer must use hazard control levels as effective as the recommended levels in widely used methods such as the Job Strain Index, the lifting guidelines in the Department of Energy ErgoEASER, the ANSI S3.34-1986 (R1997) Hand Arm Vibration Standards, the 1991 NIOSH Lifting Equation, (as described in Waters 1993), the UAW-GM Risk Factor Checklists, applicable ACGIH threshold limit values for physical agents, Rapid Entire Body Assessment (REBA), or Rapid Upper Limb Assessment (RULA).	(1) The employer must analyze “caution zone jobs” to identify those with WMSD hazards that must be reduced. A WMSD hazard is a physical risk factor that exceeds the criteria in Appendix B of this rule.
(2) The employer must analyze “caution zone jobs” using a systematic method that includes the following, if applicable: <ul style="list-style-type: none"><li>• Physical demands specific to the worksite including posture, force, repetition, repeated impacts, hand-arm vibration, duration, work pace, task variability and recovery time;</li><li>• Layout of the work area, including reaches, working heights, seating and surfaces; and</li><li>• Manual handling requirements, including size, shape, weight, and packaging.</li></ul>	(2) Same as General Performance Approach
(3) Individuals responsible for hazard analysis must know how to use the analysis method effectively and be informed about the requirements of this rule.	(3) Individuals responsible for hazard analysis must know how to use the analysis provided in Appendix B effectively and be informed about the requirements of this rule.
(4) The employer must reduce all WMSD hazards below the criteria chosen in WAC 296-62-05130(1) or to the degree technologically and economically feasible.	(4) The employer must reduce all WMSD hazards below the criteria in Appendix B of this rule or to the degree technologically and economically feasible.

<b>WAC 296-62-05130 – Analyzing and reducing WMSD hazards: General Performance Approach (cont.)</b>	<b>WAC 296-62-05130 - Analyzing and reducing WMSD hazards: Specific Performance Approach (cont.)</b>
<p><b>(5) Employers must reduce WMSD hazards as described below by:</b></p> <p>(a) Implementing controls that do not rely primarily on employee behavior to reduce WMSD hazards, such as the following:</p> <ul style="list-style-type: none"> <li>• Changes to workstations and tools</li> <li>• Reducing the size and weights of loads handled</li> <li>• Process redesign to eliminate unnecessary steps or introduce task variety</li> <li>• Job rotation</li> </ul> <p>(b) If employers cannot reduce WMSD hazards below the hazard level using the controls identified above, they must supplement those controls with interim measures that primarily rely on individual work practices or personal protective equipment. Examples of such practices include the following:</p> <ul style="list-style-type: none"> <li>• Impact gloves</li> <li>• Team lifting</li> <li>• Training on work techniques</li> </ul> <p>(c) This rule does not require an employer to control WMSD hazards by replacing full-time employees with part-time employees or otherwise reducing an individual's hours of employment. If an employer has implemented all other technologically and economically feasible controls, and a WMSD hazard remains, the employer will be deemed in compliance with this subsection.</p>	<p><b>(5) Same as General Performance Approach</b></p>
<p><b>(6) If measures to reduce WMSD hazards include changes in the job or work practices then job-specific training must be provided. This job-specific training must include:</b></p> <ul style="list-style-type: none"> <li>• The hazards of the work activities;</li> <li>• Safe work practices; and</li> <li>• The proper use and maintenance of specific measures to reduce WMSD hazards that have been implemented.</li> </ul>	<p><b>(6) Same as General Performance Approach</b></p>
<p><b>(7) No written ergonomics program is required. The employer must be able to demonstrate the following:</b></p> <ul style="list-style-type: none"> <li>• The method used to analyze "caution zone jobs";</li> <li>• The criteria used to identify WMSD hazards;</li> <li>• The jobs with identified WMSD hazards; and</li> <li>• The reduction of all WMSD hazards below the criteria chosen in WAC 296-62-05130(1) or to the degree technologically and economically feasible.</li> </ul>	<p><b>(7) No written ergonomics program is required. The employer must be able to demonstrate that all WMSD hazards have been reduced below the criteria identified in Appendix B of this rule or to the degree technologically and economically feasible.</b></p>

**WAC 296-62-05140– How must employees be kept involved and informed?**

(1) The employer must provide for and encourage employee participation in analyzing “caution zone jobs” and selecting measures to reduce WMSD hazards. Employers with eleven or more employees who are required to have safety committees (WAC 296-24-045) must involve this committee in choosing the methods to be used for employee participation.

(2) Employers with eleven or more employees must share the following information with the safety committee (if a committee is required by WAC 296-24-045). Employers who are not required to have a safety committee (WAC 296-24-045) must provide this information at safety meetings:

- The requirements of this rule;
- Identified “caution zone jobs”;
- Results of the hazard analysis and/or identification of jobs with WMSD hazards; and
- Measures to reduce WMSD hazards

(3) The employer must review its ergonomics activities at least annually for effectiveness and for any needed improvements. This review must include members of the safety committee where one exists or ensure an equally effective means of employee involvement.

**WAC 296-62-05150– How are terms and phrases used in this rule?**

Note: Check L&I’s WISHA Services web site at <http://www.lni.wa.gov/wisha/ergo> for current links to any of the web sites referred to in this section.

**ACGIH threshold limit values for physical hazards** - The American Conference of Governmental Industrial Hygienists, Thresholds Limit Values for Chemical Substances and Physical Agents in the Work Environment, and Biological Exposure Indices (TLVs and BEIs). Available for purchase at the ACGIH web site at <http://www.acgih.org>.

**ANSI S3.34-1986 (R1997) Hand Arm Vibration Standards** - American National Standard Guide for the Measurement and Evaluation of Human Exposure to Vibration Transmitted to the Hand. ANSI S3.34-1986 (R1997). Available for purchase at the ANSI web site at <http://web.ansi.org/default.htm>.

**“Caution zone jobs”** - Jobs where an employee’s typical work activities include any of the specific physical risk factors identified in WAC 296-62-05105. These jobs have a sufficient degree of risk to require ergonomics awareness education and job hazard analysis.

**Department of Energy ErgoEASER** - Ergonomics Education, Awareness, System Evaluation and Recording (ErgoEASER) software package. U. S. Department of Energy, Office of Environment, Safety, and Health (1995). Can be downloaded from the Department of Energy web site at <http://tis.eh.doe.gov/others/ergoeaser/download.htm>.

**Ergonomics** – The science and practice of designing jobs or workplaces to match the capabilities and limitations of the human body.

**Full Time Equivalent (FTE)** – The equivalent of one person working full-time for one year (2,000 worker hours per year). For example, two persons working half time count as one FTE.

## WAC 296-62-05150 (Cont.)

**High Hand-Arm Vibration Levels** - Tools with vibration values equal to or greater than 10 meters per second squared ( $\text{m/s}^2$ ) eight-hour equivalent. Examples include some impact wrenches, carpet strippers, chain saws, and percussive tools.

**Intensive Keying** – Keying with the hands or fingers in a rapid, steady motion with few opportunities for temporary work pauses.

**Job Strain Index** - The Strain Index: A proposed method to analyze jobs for risk of distal upper extremity disorders, Moore, J.S., and A. Garg, (1995). Published in American Industrial Hygiene Association Journal, volume 56, pages 443-458. Web site at <http://sg-www.satx.disa.mil/hscoemo/tools/strain.htm>.

**Moderate Hand-Arm Vibration Levels** – Tools with vibration values between 2.5 and 10 meters per second squared ( $\text{m/s}^2$ ) eight-hour equivalent. Examples include some grinders, sanders, and jig saws.

**NIOSH Lifting Equation, 1991** – Waters, T.R., Putz-Anderson, V., Garg, A., and Fine, L.J. (1993). Revised NIOSH equation for the design and evaluation of manual lifting tasks. Published in Ergonomics, volume 36 (7), pages 749-776. For a manual on using the lifting equation see: Applications Manual for Revised Lifting Equation, Waters, T., Putz-Anderson, V., Garg, A. (1994). Available from the National Technical Information Center (NTIS), Springfield, VA 22161. 1-800-553-6847.

Calculator web site at <http://www.industrialhygiene.com/calc/lift.html>.

Application guideline web site at <http://www.cdc.gov/niosh/94-110.html>.

**Rapid Entire Body Assessment tool (REBA)** - Hignett, S. and McAtamney, L. (2000) Rapid entire body assessment (REBA). Published in Applied Ergonomics volume 31, pages 201-205.

**Recovery Time** – Work periods with light task demands, or rest breaks, that permit an employee to recover from physically demanding work.

**The Rapid Upper Limb Assessment (RULA)** - McAtamney, L. and Corlett, E.N. (1993) RULA: A survey method for the investigation of work-related upper limb disorders. Published in Applied Ergonomics, volume 24 (2), pages 91-99.

**UAW-GM Risk Factor Checklists** - UAW-GM Risk Factor Checklist 2, 1998. UAW-GM (United Auto Workers-General Motors), Center for Human Resources, Health and Safety Center, 1030 Doris Road, Auburn Hills, Michigan.

**Work Activities** – The physical demands, exertions, or functions of the job or task.

**Work-Related Musculoskeletal Disorders (WMSDs)** – Work-related disorders that involve soft tissues such as muscles, tendons, ligaments, joints, blood vessels and nerves. Examples include: Muscle strains and tears, ligament sprains, joint and tendon inflammation, pinched nerves, degeneration of spinal discs, carpal tunnel syndrome, tendinitis, rotator cuff syndrome. For purposes of this rule WMSDs do not include injuries from slips, trips, falls, motor vehicle accidents or being struck by or caught in objects.

# PART 3

## WAC 296-62-05160– When must employers comply with this rule?

Employers covered by this rule must comply with its requirements by the dates shown.

INITIAL IMPLEMENTATION SCHEDULE		
Employer	Awareness Education Completed And Hazard Analysis Completed	Hazard Reduction Completed
<ul style="list-style-type: none"> <li>• All employers in SIC codes* 078, 152, 174, 175, 176, 177, 242, 421, 451, 541, 805, and 836 who employ 50 or more annual full time equivalents (FTEs) in Washington state</li> <li>• The Washington State Department of Labor &amp; Industries</li> </ul>	July 1, 2002	July 1, 2003
<ul style="list-style-type: none"> <li>• The remaining employers in SIC codes* 078, 152, 174, 175, 176, 177, 242, 421, 451, 541, 805 and 836</li> <li>• All other employers who employ 50 or more annual full time equivalents (FTEs) in Washington state</li> </ul>	July 1, 2003	July 1, 2004
All other employers employing 11-49 annual full time equivalents (FTEs) in Washington state	July 1, 2004	July 1, 2005
All other employers employing 10 or fewer annual full time equivalents (FTEs) in Washington state	July 1, 2005	July 1, 2006
SUPPLEMENTAL IMPLEMENTATION SCHEDULE		
New workplaces or businesses	One year from the date the new workplace or business is established <b>OR</b> According to the schedule above	15 months from the date the new workplace or business is established <b>OR</b> According to the schedule above
Significant changes to existing workplaces or businesses	2 months after significant changes occur <b>OR</b> According to the schedule above	3 months after significant changes occur <b>OR</b> According to the schedule above

\*Note: SIC code is the employer's primary SIC based on hours of employment. See Appendix C of this rule for descriptions of these SIC codes.

## **Help for employers in implementing the rule.**

### **(1) Developing Ergonomics Guides and Models**

The department will work with employer and employee organizations to develop guides for complying with this rule (for example, a model program for ergonomics awareness education). Employer use of these guides will be optional.

### **(2) Identifying Industry “Best Practices”**

The department will work with employer and employee organizations to develop or identify methods of reducing WMSD hazards that will serve as examples of industry-specific “best practices.” As industry-specific “best practices” are developed, they may be used to demonstrate employer compliance with the requirement to reduce WMSD hazards. Employers will not be restricted to the use of industry “best practices” for compliance.

### **(3) Establishing Inspection Policies and Procedures**

The department will develop policies and procedures for inspections and enforcement of this rule before the rule is enforced. These policies and procedures will be communicated to employers and employees through mailing lists, business associations, labor unions and other methods before the department issues any citations or penalties.

### **(4) Conducting Demonstration Projects**

Following adoption of this rule, the department will work with employers and employees to undertake demonstration projects to test and improve guidelines, “best practices” and inspection policies and procedures as they are developed.


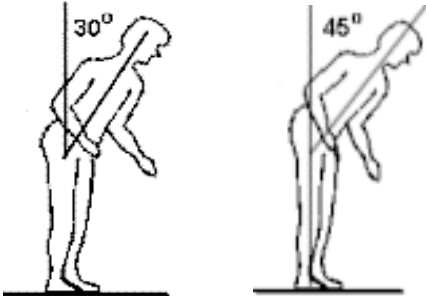
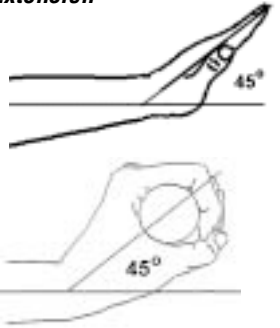
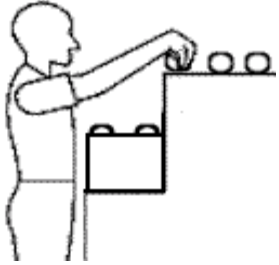

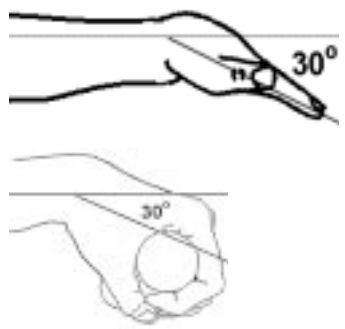
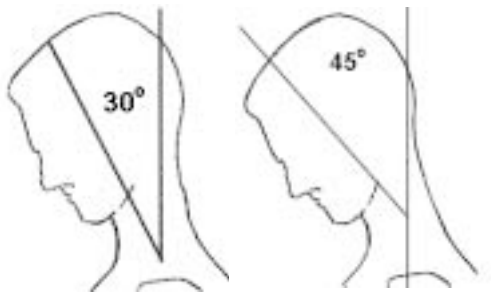


### **(5) Providing Information on Ergonomics**

The department will work with employer and employee organizations to collect and share the most effective examples of ergonomics training, job analysis, and specific solutions to problems. The department will make special efforts to share this information with the small business community


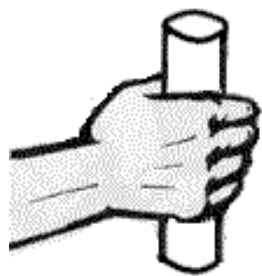
# WAC 296-62-05172 Appendix A: Illustrations of physical risk factors

The following illustrations are provided as reference only. Some users of this rule may find the pictures aid their understanding of the text in WAC 296-62-05105.



## Awkward Postures

<b>Raising the hands above the head</b> 	<b>Bending the back</b> 	<b>Bending the wrist</b> <i>Extension</i> 
<b>Raising the elbows above the shoulders</b> 	<b>Squatting</b> 	<i>Flexion</i> 
<b>Bending the neck</b> 	<b>Kneeling</b> 	<i>Ulnar deviation</i> <i>(bent towards the little finger)</i> 

## High Hand Force

<i>Pinching 2 lbs.</i> 	<i>Gripping 10 lbs.</i> 
---	--



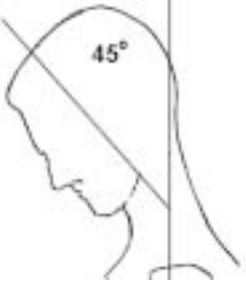


## Repeated Impacts

<i>Using the knee as a hammer</i> 	<i>Using the hand as a hammer</i> 
---	--





## WAC 296-62-05174– Appendix B: Criteria for analyzing and reducing WMSD hazards for employers who choose the Specific Performance Approach.

For each “caution zone job” find any physical risk factors that apply. Reading across the page, determine if all of the conditions are present in the work activities. If they are, a WMSD hazard exists and must be reduced below the hazard level or to the degree technologically and economically feasible (see WAC 296-62-05130(4), specific performance approach).

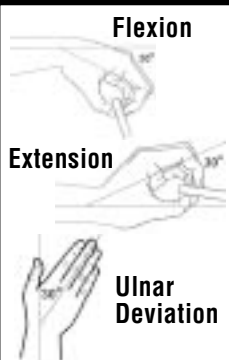



Awkward Posture				Checkmark the Box If this is a WMSD Hazard
Body Part	Physical Risk Factor	Duration	Visual Aid	
Shoulders	Working with the hand(s) above the head or the elbow(s) above the shoulder(s)	More than 4 hours total per day		<input type="checkbox"/>
	Repetitively raising the hand(s) above the head or the elbow(s) above the shoulder(s) more than once per minute	More than 4 hours total per day		<input type="checkbox"/>
Neck	Working with the neck bent more than 45° (without support or the ability to vary posture)	More than 4 hours total per day		<input type="checkbox"/>
Back	Working with the back bent forward more than 30° (without support, or the ability to vary posture)	More than 4 hours total per day		<input type="checkbox"/>
	Working with the back bent forward more than 45° (without support or the ability to vary posture)	More than 2 hours total per day		<input type="checkbox"/>

*Continues*

**WAC 296-62-05174– Appendix B: Criteria for analyzing and reducing WMSD hazards for employers who choose the Specific Performance Approach.**



<b>Awkward Posture <i>continued</i></b>				<b>Checkmark the Box If this is a WMSD Hazard</b>
<b>Body Part</b>	<b>Physical Risk Factor</b>	<b>Duration</b>	<b>Visual Aid</b>	
<b>Knees</b>	Squatting	More than 4 hours total per day		<input type="checkbox"/>
	Kneeling	More than 4 hours total per day		<input type="checkbox"/>

# **WAC 296-62-05174– Appendix B: Criteria for analyzing and reducing WMSD hazards for employers who choose the Specific Performance Approach.**

High Hand Force					Checkmark the Box If this is a WMSD Hazard
Body Part	Physical Risk Factor	Combined with	Duration	Visual Aid	
Arms, wrists, hands	Pinching an unsupported object(s) weighing 2 or more pounds per hand, or pinching with a force of 4 or more pounds per hand (comparable to pinching half a ream of paper)	Highly repetitive motion	More than 3 hours total per day		<input type="checkbox"/>
		Wrists bent in flexion 30° or more, or in extension 45° or more, or in ulnar deviation 30° or more	More than 3 hours total per day		<input type="checkbox"/>
		No other risk factors	More than 4 hours total per day		<input type="checkbox"/>
Arms, wrists, hands	Gripping an unsupported object(s) weighing 10 or more pounds per hand, or gripping with a force of 10 pounds or more per hand (comparable to clamping light duty automotive jumper cables onto a battery)	Highly repetitive motion	More than 3 hours total per day		<input type="checkbox"/>
		Wrists bent in flexion 30° or more, or in extension 45° or more, or in ulnar deviation 30° or more	More than 3 hours total per day		<input type="checkbox"/>
		No other risk factors	More than 4 hours total per day		<input type="checkbox"/>

## WAC 296-62-05174 Appendix B: Criteria for analyzing and reducing WMSD hazards for employers who choose the Specific Performance Approach.

Highly Repetitive Motion				Checkmark the Box If this is a WMSD Hazard
Body Part	Physical Risk Factor	Combined with	Duration	
Neck, shoulders, elbows, wrists, hands	Using the same motion with little or no variation every few seconds (excluding keying activities)	No other risk factors	More than 6 hours total per day	
	Using the same motion with little or no variation every few seconds (excluding keying activities)	Wrists bent in flexion 30° or more, or in extension 45° or more, or in ulnar deviation 30° or more <b>AND</b> High, forceful exertions with the hand(s)	More than 2 hours total per day	
	Intensive keying	Awkward posture, including wrists bent in flexion 30° or more, or in extension 45° or more, or in ulnar deviation 30° or more	More than 4 hours total per day	
		No other risk factors	More than 7 hours total per day	

Repeated Impact				Checkmark the Box If this is a WMSD Hazard
Body Part	Physical Risk Factor	Duration	Visual Aid	
Hands	Using the hand (heel/base of palm) as a hammer more than once per minute	More than 2 hours total per day		
Knees	Using the knee as a hammer more than once per minute	More than 2 hours total per day		

# WAC 296-62-05174– Appendix B: Criteria for analyzing and reducing WMSD hazards for employers who choose the Specific Performance Approach

## Heavy, Frequent or Awkward Lifting

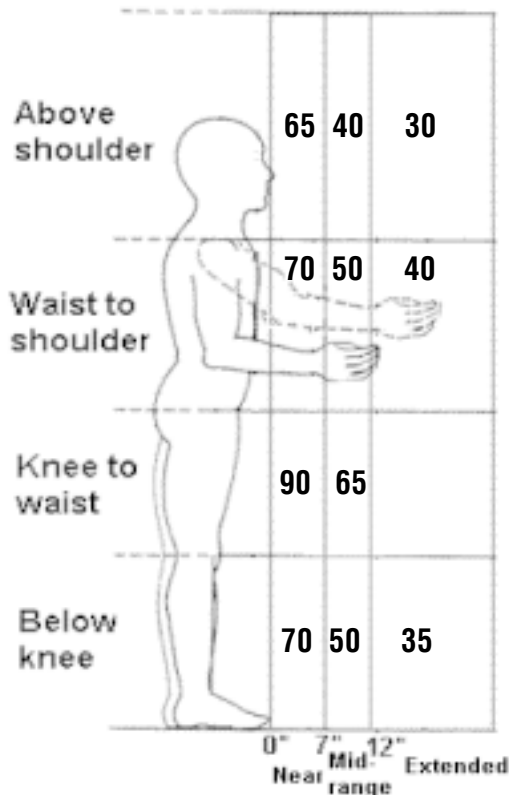
This analysis only pertains if you have “caution zone jobs” where employees lift 10 lbs. or more (see WAC 296-62-05105, Heavy, Frequent, or Awkward Lifting) and you have chosen the specific performance approach.

### STEP 1 Find out the actual weight of objects that the employee lifts.

Actual Weight = \_\_\_\_\_ lbs.

### STEP 2 Determine the Unadjusted Weight Limit.

Where are the employee’s hands when they begin to lift or lower the object? Mark that spot on the diagram below. The number in that box is the Unadjusted Weight Limit in pounds.



Unadjusted Weight Limit: \_\_\_\_\_ lbs.

Note: If the job involves lifts of objects with a number of different weights and/or from a number of different locations, use Steps 1 through 5 above to:

1. Analyze the two worst case lifts —the heaviest object lifted and the lift done in the most awkward posture.

2. Analyze the most commonly performed lift.

In Step 3, use the frequency and duration for all of the lifting done in a typical workday.

### STEP 3

**Find the Limit Reduction Modifier.** Find out how many times the employee lifts per minute and the total number of hours per day spent lifting. Use this information to look up the Limit Reduction Modifier in the table below.

How many lifts per minute?	For how many hours per day?		
	1 hr or less	1 hr to 2 hrs	2 hrs or more
1 lift every 2-5 mins.	1.0	0.95	0.85
1 lift every min	0.95	0.90	0.75
2-3 lifts every min	0.90	0.85	0.65
4-5 lifts every min	0.85	0.70	0.45
6-7 lifts every min	0.75	0.50	0.25
8-9 lifts every min	0.6	0.35	0.15
10+ lifts every min	0.3	0.20	0.0

Note: For lifting done less than once every five minutes, use 1.0

Limit Reduction Modifier: \_\_\_\_\_

### STEP 4

**Calculate the Weight Limit.** Start by copying the Unadjusted Weight Limit from Step 2.

Unadjusted Weight Limit: \_\_\_\_\_ = \_\_\_\_\_ lbs.

If the employee twists more than 45 degrees while lifting, reduce the Unadjusted Weight Limit by multiplying by 0.85. Otherwise, use the Unadjusted Weight Limit

Twisting Adjustment: = \_\_\_\_\_

Adjusted Weight Limit: = \_\_\_\_\_ lbs.

Multiply the Adjusted Weight Limit by the Limit Reduction Modifier from Step 3 to get the Weight Limit.

X  
Limit Reduction Modifier: \_\_\_\_\_

Weight Limit: = \_\_\_\_\_ lbs.

### STEP 5

**Is this a hazard?** Compare the Weight Limit calculated in Step 4 with the Actual Weight lifted from Step 1. If the Actual Weight lifted is greater than the Weight Limit calculated, then the lifting is a WMSD hazard and must be reduced below the hazard level or to the degree technologically and economically feasible.

# WAC 296-62-05174 Appendix B: Criteria for analyzing and reducing WMSD hazards for employers who choose the Specific Performance Approach.

## Hand-Arm Vibration

Use the instructions below to determine if a hand-arm vibration hazard exists.

Step 1. Find the vibration value for the tool. (Get it from the manufacturer, look it up at this web site: <http://umetech.niwl.se/vibration/HAVHome.html>, or you may measure the vibration yourself). The vibration value will be in units of meters per second squared ( $\text{m/s}^2$ ). On the graph below find the point on the left side that is equal to the vibration value.

*Note: You can also link to this web site through the L&I WISHA Services Ergonomics web site: <http://www.lni.wa.gov/wisha/ergo>*

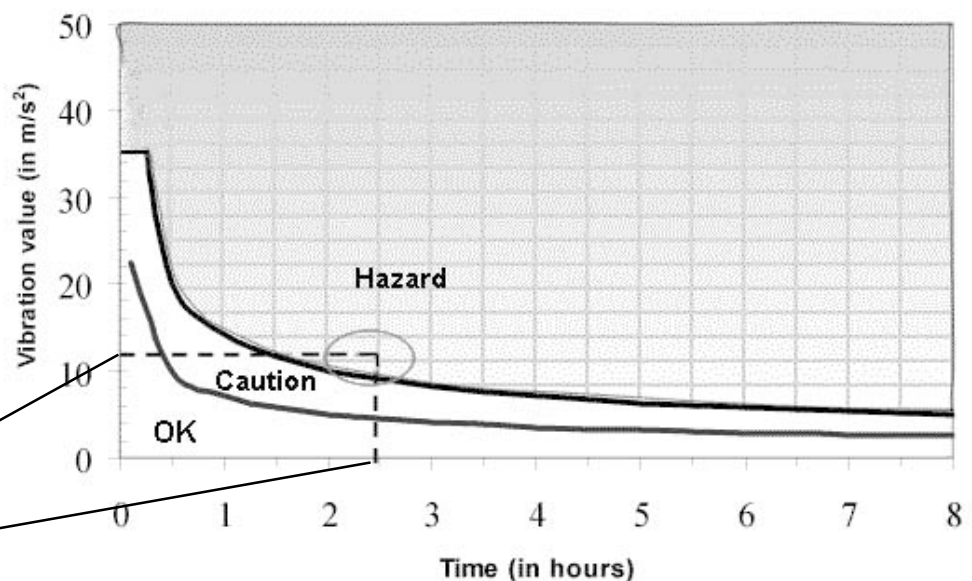
Step 2. Find out how many total hours per day the employee is using the tool and find that point on the bottom of the graph.

Step 3. Trace a line in from each of these two points until they cross.

Step 4. If that point lies in the crosshatched "Hazard" area above the upper curve, then the vibration hazard must be reduced below the hazard level or to the degree technologically and economically feasible. If the point lies between the two curves in the "Caution" area, then the job remains as a "Caution Zone Job." If it falls in the "OK" area below the bottom curve, then no further steps are required.

### Example:

An impact wrench with a vibration value of  $12 \text{ m/s}^2$  is used for  $2\frac{1}{2}$  hours total per day. The exposure level is in the Hazard area. The vibration must be reduced below the hazard level or to the degree technologically and economically feasible.



Note: The caution limit curve (bottom) is based on an 8-hour energy-equivalent frequency-weighted acceleration value of  $2.5 \text{ m/s}^2$ . The hazard limit curve (top) is based on an 8-hour energy-equivalent frequency-weighted acceleration value of  $5 \text{ m/s}^2$ .

## WAC 296-62-05176– Appendix C:

### Standard Industry Classification (SIC) codes.

The descriptive titles for the SIC codes listed in the implementation schedule (WAC 296-62-05160) are provided below. SIC codes are established by the federal Office of Management and Budget and are listed in the Standard Industrial Classification Manual, 1987 edition.

SIC*	INDUSTRY	EXAMPLES
078	Landscape and Horticultural Services	<ul style="list-style-type: none"> <li>• lawn and garden services</li> <li>• ornamental shrub and tree services</li> </ul>
152	General Building Contractors, Residential Buildings	<ul style="list-style-type: none"> <li>• general contractors single family houses</li> <li>• general contractors residential buildings other than single family</li> </ul>
174	Masonry, Stonework, Tile Setting & Plastering	<ul style="list-style-type: none"> <li>• masonry, stone setting, and other stone work</li> <li>• plastering, drywall, acoustical, and insulation work</li> <li>• terrazzo, tile, marble, and mosaic work</li> </ul>
175	Carpentry and Floor Work	<ul style="list-style-type: none"> <li>• carpentry work</li> <li>• floor laying and other floor work (NEC**)</li> </ul>
176	Roofing, Siding and Sheet Metal	<ul style="list-style-type: none"> <li>• installation of roofing, siding, and sheet metal work</li> </ul>
177	Concrete Work	<ul style="list-style-type: none"> <li>• includes portland cement and asphalt</li> </ul>
242	Sawmills & Planing Mills	<ul style="list-style-type: none"> <li>• sawmills and planing mills</li> <li>• hardwood dimension and flooring mills</li> <li>• special products sawmills (NEC**)</li> </ul>
421	Trucking & Courier Service, non- air	<ul style="list-style-type: none"> <li>• trucking</li> <li>• local trucking with or without storage</li> <li>• courier services (except by air)</li> </ul>
451	Air Transportation, Scheduled and Air Courier	<ul style="list-style-type: none"> <li>• scheduled air transportation</li> <li>• air courier services</li> </ul> <p><i>Note: WISHA jurisdiction excludes planes in flight.</i></p>
541	Grocery Stores	<ul style="list-style-type: none"> <li>• supermarkets</li> <li>• food stores</li> <li>• grocery stores</li> </ul>
805	Nursing & Personal Care	<ul style="list-style-type: none"> <li>• skilled nursing care facilities</li> <li>• intermediate care facilities</li> <li>• nursing and personal care facilities, (NEC**)</li> </ul>
836	Residential Care	<ul style="list-style-type: none"> <li>• establishments primarily engaged in the provision of residential social and personal care for children, the aged, and special categories of persons with some limits on ability for self-care, but where medical care is not a major element.</li> </ul>

\*SIC or NAICS equivalent. In 2000, federal agencies that produce statistical data will adopt NAICS (North American Industry Classification System) codes and begin to phase out the SIC codes. State and local government agencies also will use this new coding structure to promote a common language for categorizing today's industries.

\*\*NEC - not elsewhere classified

# Checklists

The checklists on the following pages are included for you to copy and use in your analysis for Caution Zone Jobs and hazards. They also can be found on the WISHA ergonomics Website at:

**[http://www.LNI.wa.gov/wisha/ergo/eval\\_tools/default.htm](http://www.LNI.wa.gov/wisha/ergo/eval_tools/default.htm)**

**As a reminder, sawmill employers must comply with the ergonomics rule on the following schedule:**

## **If you have 50 or more FTE (full-time equivalent\*) employees**

### **BY JULY 1, 2002 YOU MUST:**

1. Determine if your workplace has Caution Zone Jobs.
2. Complete Ergonomics Awareness Education for employees and their supervisors who work in Caution Zone Jobs.
3. Analyze your Caution Zone Jobs for hazards.

### **BY JULY 1, 2003 YOU MUST:**

Reduce any hazardous jobs you find below hazard level or to the degree technologically and economically feasible.

## **If you have fewer than 50 FTE (full-time equivalent\*) employees**

### **BY JULY 1, 2003 YOU MUST**

1. Determine if your workplace has Caution Zone Jobs.
2. Complete Ergonomics Awareness Education for employees and their supervisors who work in Caution Zone Jobs.
3. Analyze your Caution Zone Jobs for hazards.

### **BY JULY 1, 2004 YOU MUST:**

Reduce any hazardous jobs you find below hazard level or to the degree technologically and economically feasible.

\* Full-Time Equivalent (FTE) - The Equivalent of one person working full-time for one year (2,000 worker hours per year). For example, two persons working half-time count as one FTE.





# Caution Zone Checklist (WAC 296-62-05105)

Use one sheet for each position evaluated.

Movements or postures that are a regular and foreseeable part of the job, occurring more than one day per week, and more frequently than one week per year.

If done in this job position



the box

Job Position evaluated:

Date:

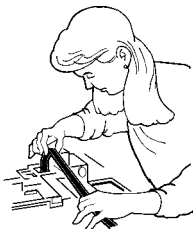
No. of employees in these jobs?

## Awkward Posture

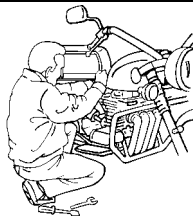
## Comments/Observations



1. Working with the hand(s) above the head, or the elbow(s) above the shoulders more than 2 hours total per day.

☐


2. Working with the neck or back bent more than 30 degrees (without support and without the ability to vary posture) more than 2 hours total per day.

☐


3. Squatting more than 2 hours total per day.

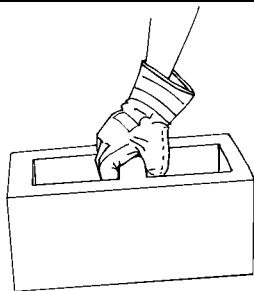
☐


4. Kneeling more than 2 hours total per day.

☐

## High Hand Force

## Comments/Observations

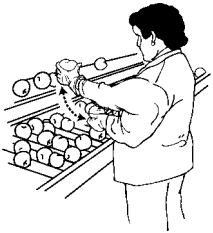


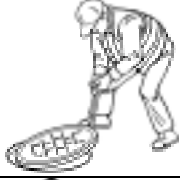


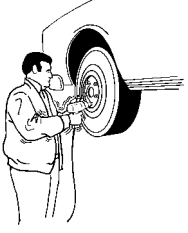



5. Pinching an unsupported object(s) weighing 2 or more pounds per hand, or pinching with a force of 4 or more pounds per hand, more than 2 hours per day (comparable to pinching half a ream of paper).

☐


6. Gripping an unsupported object(s) weighing 10 or more pounds per hand, or gripping with a force of 10 or more pounds per hand, more than 2 hours total per day (comparable to clamping light duty automotive jumper cables onto a battery).

☐

Highly Repetitive Motion		Comments/Observations
 <p><b>7.</b> Repeating the same motion with the neck, shoulders, elbows, wrists, or hands (excluding keying activities) with little or no variation every few seconds, more than 2 hours total per day.</p>	<input type="checkbox"/>	
 <p><b>8.</b> Performing intensive keying more than 4 hours total per day.</p>	<input type="checkbox"/>	
Repeated Impact		Comments/Observations
 <p><b>9.</b> Using the hand (heel/base of palm) or knee as a hammer more than 10 times per hour, more than 2 hours total per day.</p>	<input type="checkbox"/>	
Heavy, Frequent or Awkward Lifting (A simple scale can be used to determine the weight of materials)		Comments/Observations
 <p><b>10.</b> Lifting object weighing more than 75 pounds once per day or more than 55 pounds more than 10 times per day.</p>	<input type="checkbox"/>	
 <p><b>11.</b> Lifting objects weighing more than 10 pounds if done more than twice per minute, more than 2 hours total per day.</p>	<input type="checkbox"/>	
 <p><b>12.</b> Lifting objects weighing more than 25 pounds above the shoulders, below the knees or at arms length more than 25 times per day.</p>	<input type="checkbox"/>	
Moderate to High Hand- Arm Vibration (Closely estimate or obtain the vibration value of the tool in use)		Comments/Observations
 <p><b>13.</b> Using impact wrenches, carpet strippers, chain saws, percussive tools (jack hammers, scalers, riveting or chipping hammers) or other tools that typically have high vibration levels, more than 30 minutes total per day.</p>	<input type="checkbox"/>	
 <p><b>14.</b> Using grinders, sanders, jigsaws or other hand tools that typically have moderate vibration levels more than 2 hours total per day.</p>	<input type="checkbox"/>	

# HAZARD ZONE CHECKLIST (APPENDIX B) - WAC 296-62-05174

For each "caution zone job" find any physical risk factors that apply. If a hazard exists, it must be reduced below the hazard level or to the degree technologically and economically feasible.

**Movements or postures that are a regular and foreseeable part of the job, occurring more than *one day per week*, and more frequently than *one week per year*.**

**Hazard  
Exists**



Job Position evaluated:

No. of  
employees in  
these jobs?

Date:

## Awkward Posture

## Comments/Observations



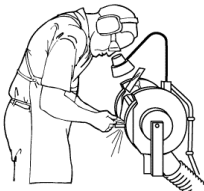
**1.** Working with the hand(s) above the head, or the elbows above the shoulders

More than  
**4 hours  
total** per  
day

☐

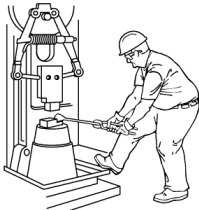

**2.** Repeatedly raising the hand(s) above the head, or the elbow(s) above the shoulder(s) more than once per minute

More than  
**4 hours  
total** per  
day

☐


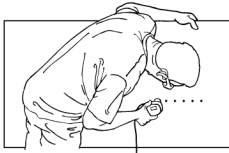
**3.** Working with the neck bent more than 45° (without support or the ability to vary posture)

More than  
**4 hours  
total** per  
day

☐


**4.** Working with the back bent forward more than 30° (without support or the ability to vary posture)

More than  
**4 hours  
total** per  
day

☐


**5.** Working with the back bent forward more than 45° (without support or the ability to vary posture)

More than  
**2 hours  
total** per  
day

☐


**6.** Squatting

More than  
**4 hours  
total** per  
day

☐


**7.** Kneeling

More than  
**4 hours  
total** per  
day

☐

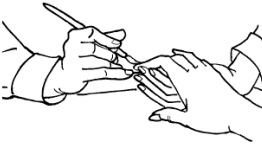
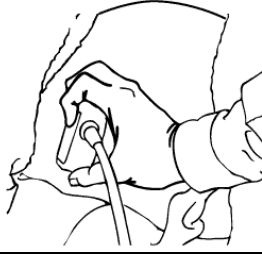
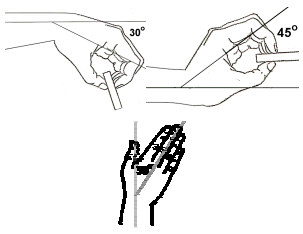

## High Hand Force

Hazard  
Exists


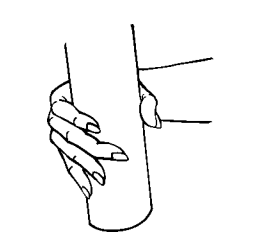
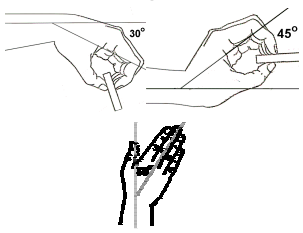
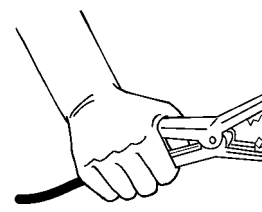



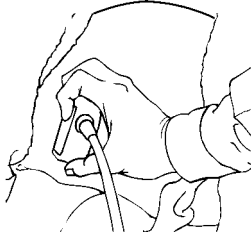
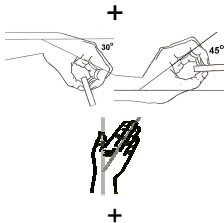


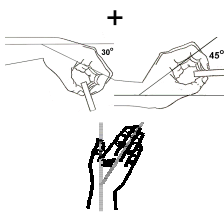

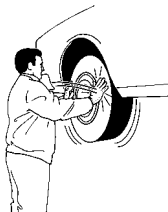
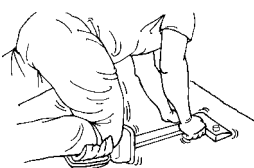
## Comments/Observations

**Pinching** an unsupported object(s) weighing 2 lbs or more per hand, or pinching with a force of 4 lbs or more per hand (comparable to pinching a half a ream of paper)

8.		+	Highly repetitive motion	+	More than 3 hours total per day	<input type="checkbox"/>	
9.		+		+	More than 3 hours total per day	<input type="checkbox"/>	
10.			No other risk factors	+	More than 4 hours total per day	<input type="checkbox"/>	

**Gripping** an unsupported object(s) weighing 10 lbs or more per hand, or gripping with a force of 10 lbs or more per hand (comparable to clamping light duty automotive jumper cables onto a battery)

11.		+	Highly Repetitive motion	+	More than 3 hours total per day	<input type="checkbox"/>	
12.		+		+	More than 3 hours total per day	<input type="checkbox"/>	
13.			No other risk factors	+	More than 4 hours total per day	<input type="checkbox"/>	

Highly Repetitive Motion			Hazard Exists 	Comments/ Observations
Using the same motion with little or no variation every few seconds (excluding keying activities)				
14.	  <p>High, forceful exertions with the hand(s)</p>	+ More than <b>2 hours</b> <i>total</i> per day	<input type="checkbox"/>	
15.	 <p>No other risk factors</p>	+ More than <b>6 hours</b> <i>total</i> per day	<input type="checkbox"/>	
Intensive keying				
16.	 	+ More than <b>4 hours</b> <i>total</i> per day	<input type="checkbox"/>	
17.	 <p>No other risk factors</p>	+ More than <b>7 hours</b> <i>total</i> per day	<input type="checkbox"/>	
Repeated Impact				Comments/ Observations
18.	 <p>Using the hand (heel/base of palm) as a hammer more than once per minute</p>	+ More than <b>2 hours</b> <i>total</i> per day	<input type="checkbox"/>	
19.	 <p>Using the knee as a hammer more than once per minute</p>	+ More than <b>2 hours</b> <i>total</i> per day	<input type="checkbox"/>	

# Appendix B: Calculator for analyzing lifting operations

Company

Evaluator

Job

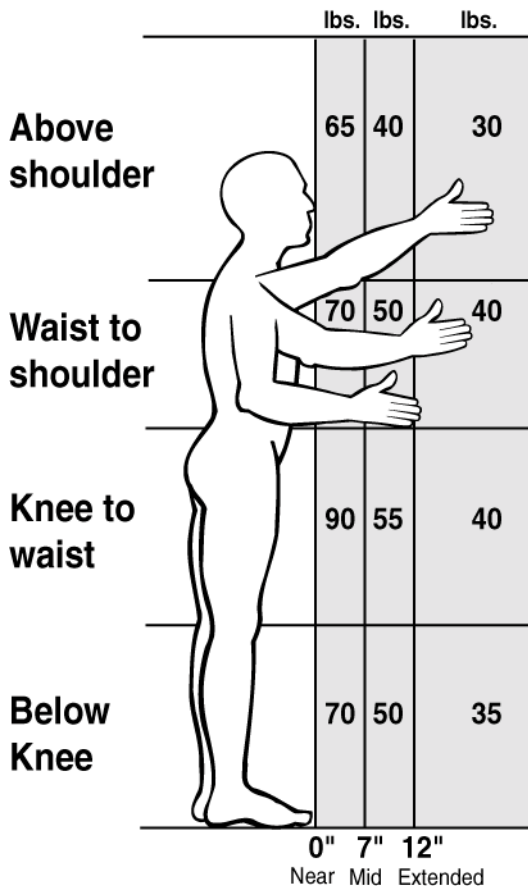
Date

- 1** Enter the weight of the object lifted.

Weight Lifted

lbs.

- 2** Circle the number on a rectangle below that corresponds to the position of the person's hands when they begin to lift or lower the objects.



- 3** Circle the number that corresponds to the times the person lifts per minute and the total number of hours per day spent lifting.

**Note:** For lifting done less than once every five minutes, use 1.0

How many lifts per minute?	How many hours per day?		
	1 hr or less	1 hr to 2 hrs	2 hrs or more
1 lift every 2-5 min	1.0	0.95	0.85
1 lift every min	0.95	0.9	0.75
2-3 lifts every min	0.9	0.85	0.65
4-5 lifts every min	0.85	0.7	0.45
6-7 lifts every min	0.75	0.5	0.25
8-9 lifts every min	0.6	0.35	0.15
10+ lifts every min	0.3	0.2	0.0

- 4** Circle 0.85 if the person twists 45 degrees or more while lifting.

0.85

Otherwise circle 1.0

- 5** Copy below the numbers you have circled in steps 2, 3, and 4.

lb.	X		X		=	Lifting Limit
Step 2		Step 3		Step 4		lb.

- 6** Is the Weight Lifted (1) less than the lifting Limit (5)?

Yes – OK

No – HAZARD

Note: If the job involves lifts of objects with a number of different weights and/or from a number of different locations, use Steps 1 through 5 above to:

- Analyze the 2 worst case lifts – the heaviest object lifted and the lift done in the most awkward posture.
- Analyze the most commonly performed lift. In step 3, use frequency and duration for all the lifting done in a typical workday.

Department of  
**LABOR AND  
INDUSTRIES**



## Appendix B: Calculator for analyzing lifting operations

### 7 SOLUTIONS PRINCIPLES

To find the most appropriate solution for this job, look for the lowest number you used to do the calculations (2, 3, 4)

<b>HANDS POSITION (2)</b> <ul style="list-style-type: none"><li>• Reduce the horizontal distance from the body</li><li>• Remove barriers, obstacles</li><li>• Reduce weight of load</li><li>• Reduce capacity of the container</li><li>• Team lift the object with two or more workers</li><li>• Design workstation with the adjustable heights to eliminate trunk bent forward</li><li>• Provide handholds</li><li>• Store objects at 30 inches off the floor</li></ul>	<b>FREQUENCY (3)</b> <ul style="list-style-type: none"><li>• Increase weight of a load so it requires mechanical assist</li><li>• Improve layout to minimize manual material handling</li><li>• Use mobile storage racks</li></ul>
<b>DURATION (3)</b> <ul style="list-style-type: none"><li>• Use mechanical assist such as overhead hoist, manipulator, vacuum lift, pneumatic balancer, forklift</li><li>• Eliminate the use of deep shelves</li><li>• Job rotation to other jobs where no lifting is required</li></ul>	<b>TWISTING (4)</b> <ul style="list-style-type: none"><li>• Redesign workstation layout to eliminate trunk twisting</li><li>• Locate lifting operations in front of the body</li><li>• Use slides, gravity, chutes to eliminate lifting/twisting</li></ul>



## Appendix B: Calculator for Hand-Arm Vibration

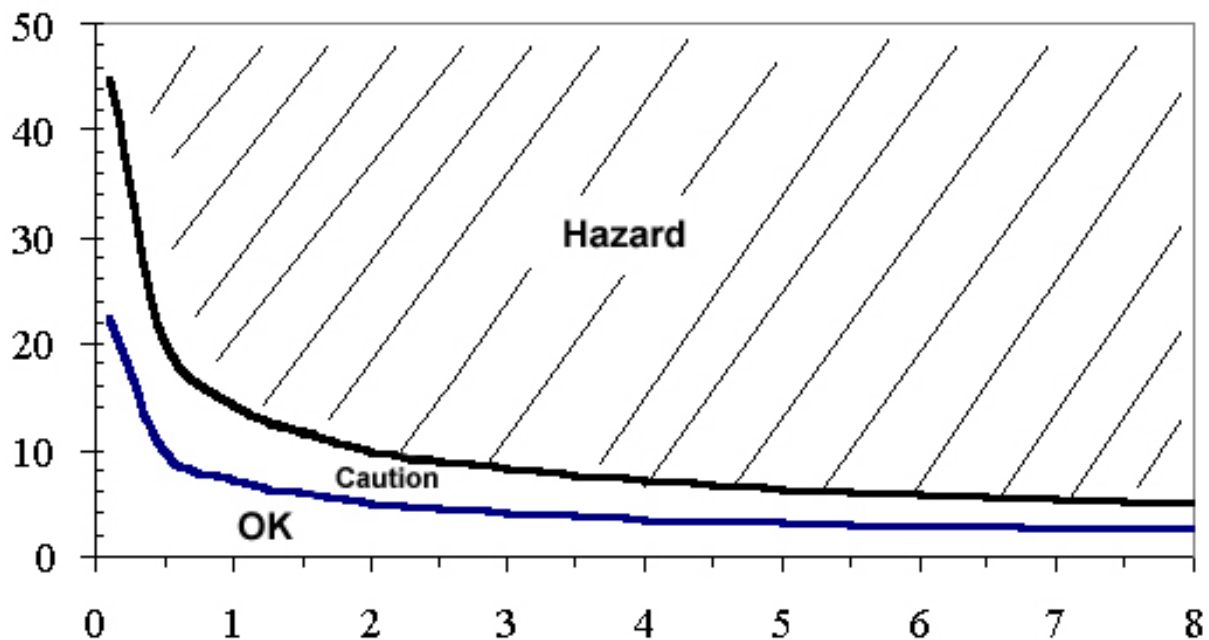
1. Find the vibration value for the tool. (Get it from the manufacturer look it up at this website <http://umetech.niwl.se/Vibration/action.lasso?-database=HAVbase.fp3&-layout=Normal&-response=HAVSearch.html&-show> On the graph below mark the point on the left side shown as Vibration value.

Vibration
m/s <sup>2</sup>

2. Find out how many total hours per day the employee is using the tool and mark that point on the bottom of the chart below.

Duration
Hrs.

3. Trace a line into the graph from each of these two points until they cross.



### 4. Interpretation

- a. If that point lies in the crosshatched "Hazard" area above the upper curve, then the vibration hazard must be reduced below the hazard level or to the degree technologically and economically feasible.
- b. If the point lies between the two curves in the "Caution" area, then the job remains as a "Caution Zone Job."
- c. If the point falls in the "OK" area below the bottom curve, then no further steps are required.

Note: The caution limit curve (bottom) is based on an 8-hour energy-equivalent frequency- weighted acceleration value of 2.5 m/s<sup>2</sup>. The hazard limit curve (top) is based on an 8-hour energy-equivalent frequency- weighted acceleration value of 5 m/s<sup>2</sup>.